JPRS-JST-86-021

1 AUGUST 1986

Japan Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-JST-86-021

1 AUGUST 1986

JAPAN REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

/12675

MARCH 1986 PETROLEUM STATISTICS REPORTED

Tokyo SEKIYU SHIRYO GEPPO in Japanese Apr 86 pp 189-191

[Text] Current Petroleum Statistics (Mar 1986)

(1) Supply and demand for crude oil

1) Crude oil imports: 19.74 million kl, an increase of 100.3 percent compared to the previous month.

While crude oil imports have remained at a low level in expectation of lower future prices, they rebounded this month to approximately the same level as last year's, partly to compensate for the previous low level of imports.

Comspicuous this month is the fact that imports from Saudi Arabia, which recently have stayed at a low level, have recovered to 3.78 million kl with a fourfold increase in the delivery of Arabian light. This month's imports represent 71.2 percent of last year's, in the corresponding month.

Shares of oil imports according to country of origin are: UAE (United Arab Emirates) 23.1 percent, Saudi Arabia 19.1 percent, Indonesia 10.6 percent, Oman 7.1 percent and Qatar 6.5 percent.

2) Amount of crude oil processed (limited to refiners): 15,090,000 kl, 92.2 percent of the same month in 1985.

A decrease of 7.8 percent compared to the same month in 1985, partially due to an effort to decrease a stockpile of finished and semi-finished products caused by a high level of processing in January and Feburary.

Crude oil processing in FY85 was at 179.63 million kl, 2.22 milllion kl over the 177.74 million kl in the revised Supply Plan.

3) Shipment for other than refinery uses: 1.51 million kl, 143.6 percent of the same month in 1985.

1. Electric generation: 1.41 million kl, 144.3 percent of the same month in 1985.

2. Petroleum chemicals: 100,000 kl, 135.7 percent of the same month in 1985.

4) Crude oil in storage: 27.12 million kl, 93.7 percent of the same month in 1985 (111.6 percent of the previous month)

Itemized Locations

Refineries	22.37 million kl (an increase of 2.28 million kl from the previous month)
Bases and oil-tank grounds	4.75 million kl (an increase of 540,000 kl from the previous month)
Total	27.12 million kl (an increase of 2.82 million kl from the previous month)

(2) Supply and demand for petroleum products

1) Production: 13.82 million kl (exclusive of 280,000 kl used as fuel), 93.3 percent of the same month in 1985.

Production was lower than last year's figures except for naphtha (118.5 percent of the same month in 1985), light oil (100.8 percent of the same month in 1985) and heavy oil A (100.6 percent of the same month in 1985), due to a reduction in crude oil processing and stocks. Production of naphtha increased in comparison to the same month in 1985 when production was drastically lower than in March 1984, since adjustment was made by decreasing stocked products. Productions of gasoline (92 percent), jet fuel (95.6 percent), kerosene (99.2 percent) heavy oil B (92.9 percent) and heavy oil C (78.6 percent) were all lower than in the same month of 1985.

In terms of the rates, gains were very low for heavy oil B and C, at 19.01 percent, while for four intermediate products, gains were high at 43.85 percent. When itemized, the rate of gain for gasoline/ naphta was 26.89 percent (24.88 percent of the previous month), for four intermediate products, 43.85 percent (41.72 percent of the previous month) and for heavy oil B/C, 19.01 percent (25.09 percent of the previous month.)

2) Sales: 16.74 million kl, 97.6 percent of the same month in 1985

Sales of all the products, except for heavy oils, showed steady gains over figures [obtained in the same month] of last year, most notably in the case of transportation-related products. In March 1985, however, sales in every product decreased drastically; the general level of sales was low, partly in expectation of lower prices.

1. Gasoline (102.2 percent of the same month in 1985)

The retail price for regular gasoline was Y139/liter, Y8/liter lower than in March 1985 (Economics Research Group. Economics Research Report)

2. Naphtha (103 percent of the same month in 1985)

Ethylene production in March was at 327,000 tons, about the same as it was last year (99.4 percent.) Naphtha sales were up by 3 percent, a solid increase.

3. Kerosene (104.1percent of the same month in 1985)

The average (national) temperature in March, 6.2 Celsius (C), was at the level of a normal year (6.3 C.) Demand increased solidly, for the chill persisted into early March. Consequently, there were many days when the temperature did not go above the average, especially in areas of Western Japan. The price, including delivery fees, was at Y1,287/18 liter, lower than that of the same month of last year by Y125/18 liter (MITI kerosene monitor survey.)

4. Light oils (104.3 percent of the same month in 1985)

Demand again increased steadily this month, aided partly by stable low pricing, a record for 10 consecutive months surpassing last year's performance. The price was Y97/liter retail, lower by Y7 as compared to last year's Y104 (Economics Research Group. Economy Survey Report.)

5. Heavy oil A (96.8 percent of the same month in 1985)

Demand was lower by 3.2 percent, compared with the same month of the last year, probably as a reaction to the temporary demand caused by the severe cold of January-February.

6. Heavy oil C (82.8 percent of the same month in 1985)

A) Electric generation (98.3 percent of the same month in 1985) (national)

a. Demand for electricity and amount of electricity generated and received (total for nine electric companies): Total demand for electric power, for illumination as well as electric power, was at 42.6 billion kwh, a solid increase (an increase of 3 percent compared to last year's figure.)

Due to the severe climate of Feburary and early March, demand for illumination, business and small [industrial] use were all increased greatly, while large [industrial] use decreased slightly by 1 percent.

Similarly, the amount of generated and received electricity increased solidly to 48.5 billion kwh (an increase of 2.7 percent compared to the same month in 1985.) Itemized, the figures were hydroelectric power (a decrease of 30.6 percent), atomic electric power (an increase of 16.9 percent of the same month in 1985) and fossil fuel electric power (an increase of 8.1 percent, compared to the same month in 1985, respectively.)

b. Fuel consumption (national) Looking over itemized fuel consumption, use of coal has increased drastically. In terms of petroleum-related fuels purchased, the figures were heavy oils (88.4 percent of the same month in 1985), crude oil (163.6 percent of the same month in 1985) and naphtha (116.7 percent of the same month in 1985.) Receipt of crude oil increased rapidly, since burning crude oil as it is, is more economical, in comparison to the

burning of heavy oil L/S. Receipt of naphtha also increased because of the advantage of a low price. As a result, the use of heavy oil C for electric power generation has been lower than that for the previous year over 19 consecutive months.

B. Other uses (78 percent of the same month in 1985)

(3) Exports and imports

1. Imports: 2.65 million kl, 123.7 percent of the same month of 1985

2. Exports: 210,000 kl, 56.9 percent of the same month of 1985

Imports of petroleum products were at a higher level than in the revised supply plan: Gasoline 205,000 kl, kerosene 313,000 kl and light oil 203,000 kl.

(4) Quantity in storage (exclusive of retailers): 11.63 million kl, 102.3 percent of the same month of 1985.

While production in March remained at a low level, the quantity in storage increased by 2.3 percent as compared to that of the previous year, due to failure to dispose of what was already stored (mostly intermediate reserves.)

(Figures given are from current statistics)

Figure 1 Crude oil imports

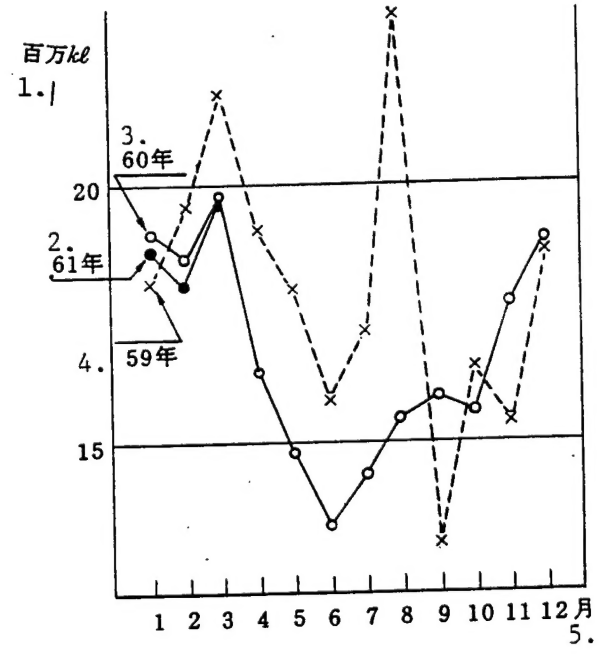
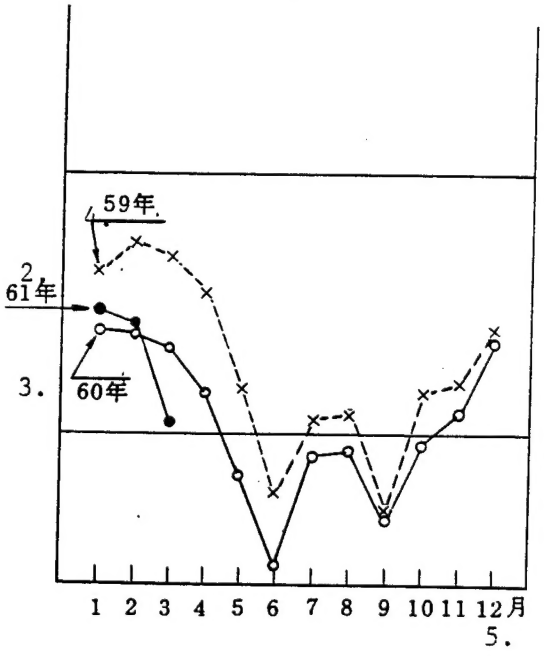


Figure 2 Crude oil processed



1. One million
2. 1986 3. 1985 4. 1984 5. Month

Figure 3 Demand for fuel oil

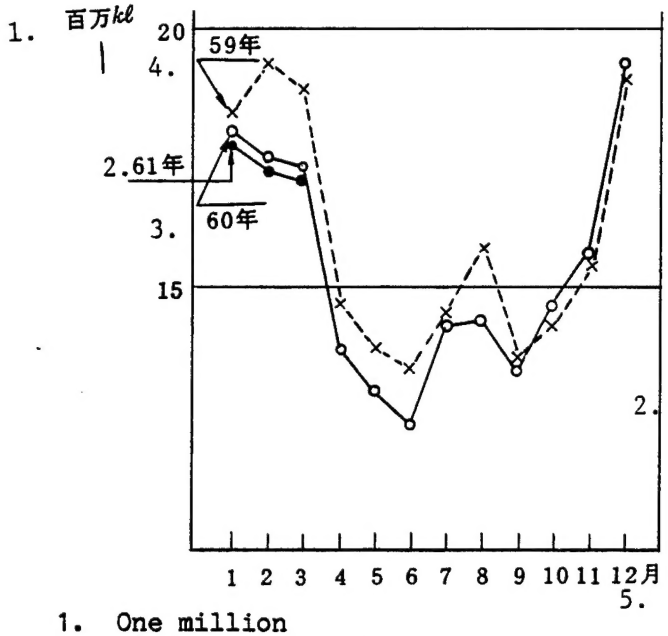
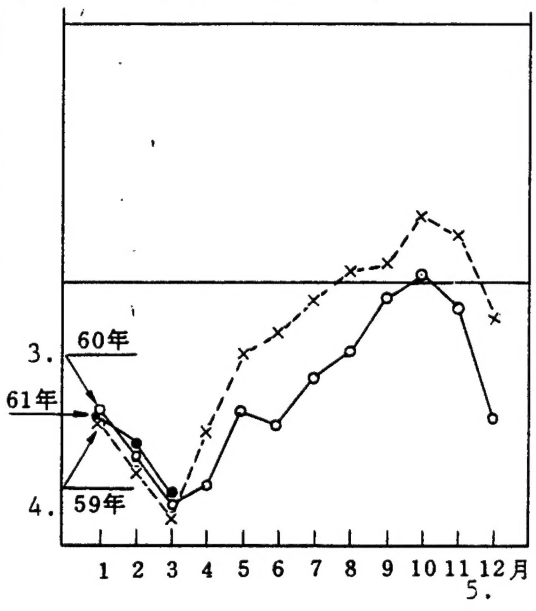


Figure 4 Fuel oil in storage (exclusive of retailers)



1. One million
2. 1986 3. 1985 4. 1984 5. Month

Table 3 Changes in domestic demand for fuel oil

(unit: 1,000 kl, percent)

1. 月 ＼ 項目	6. 国内需要量			7. 前年同月比増・減(△)		
	8. 60年度	9. 59年度	10. 58年度	8. 60年度	9. 59年度	10. 58年度
4	13,523	14,636	14,090	△ 7.6	3.9	△ 3.3
5	12,862	13,614	12,903	△ 5.5	5.5	△ 1.7
6	12,498	13,393	13,166	△ 6.7	1.7	△ 3.6
7	14,111	14,516	14,096	△ 2.8	3.0	△ 5.8
8	14,178	15,528	14,692	△ 8.7	5.7	5.6
9	13,243	13,970	14,768	△ 5.2	△ 5.4	7.0
10	14,318	14,240	14,693	0.5	△ 3.1	4.4
11	15,478	15,376	15,968	0.7	△ 3.7	0.5
12	18,878	18,789	19,550	0.5	△ 3.9	8.1
2. (翌年) 1	17,640	17,792	18,407	△ 0.9	△ 3.3	10.4
2	※17,161	17,409	19,490	※△ 1.4	△ 10.7	17.2
3	※16,739	17,155	19,136	※△ 2.4	△ 10.4	10.1
3. 上期	80,416 (82,126) ((80,416))	85,656 (84,908)	83,715 (79,689)	△ 6.1	2.3	△ 0.4
4. 下期	※100,214 (98,852) ((97,967))	100,762 (101,059)	107,245 (95,553)	※△ 0.5	△ 6.0	8.7
5. 年度計	※180,629 (180,978) ((178,383))	186,418 (185,967)	190,960 (175,242)	※△ 3.1	△ 2.4	4.5

[key on following page]

1. Month
2. (following year)
3. The first half year
4. The second half year
5. Total for FY
6. Domestic demand
7. Increase/decrease ( ) in comparison to the same month of the previous year
8. FY 85 9. FY 84 10. FY 83

(Note) Figures are from Monthly Energy Statistics (* from current statatistics.) However, figures in parentheses for FY 83, FY 84 and FY 85 are from original petroleum supply plans established in May 1983, June 1984 and June 1985, respectively. Figures in double parentheses [(( ))] are from the revised supply plan, revised in January 86.

12257
CSO: 4306/2084

METALLURGICAL INDUSTRY

DIVERSIFICATION PLANS OF HEAVY INDUSTRIES DISCUSSED

Tokyo TOSHI KEIZAI in Japanese Oct 85 pp 6-26

[Article by Editor]

[Text] Structural Change Reflected in Earnings

The change from the traditional heavy type to the light and soft type industrial structure was the major feature of the change in industrial structure in the 1975-1984 period.

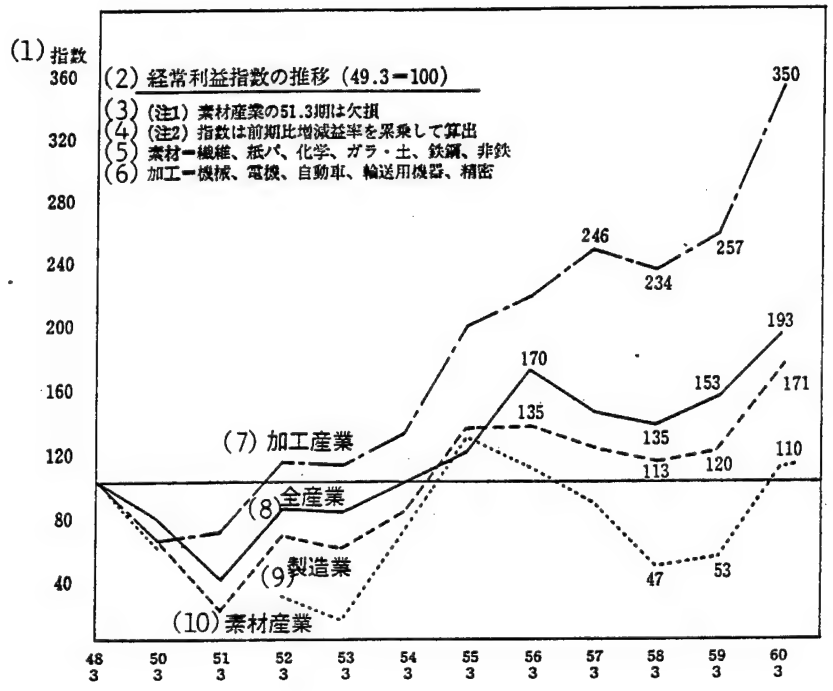
There are various ways of viewing the reality of this structural change, but it is most typically represented by the trends in profits. The graph given separately shows the changes in the index of ordinary profit, with the index set at 100 for the business year 1973 when the profits of enterprises in the 1965-1974 period reached their peak. What is clear from this graph is that the gap between the profits in the processing and basic materials industries expanded rapidly, with FY 1980 as a turning point.

In other words, the processing industry is the light and soft type with higher added values while the basic materials industry is the traditional heavy type. It seems all right to take such a view, on the whole, although it is hard to say that there is complete conceptual agreement on this matter.

At any rate, the index of ordinary profit in the processing industry in 1976 exceeded the 1973 peak. In 1984 it reached 350, a level 3.5 times the peak in 1973. As for the basic materials industry, on the other hand, the index in 1979 was 127, exceeding the peak in 1973, but thereafter it shifted to a lower level, stopping in 1984 at the level of 110. During this 10-year period, the gap between the two kinds of industries became decisive.

As can be seen in this expansion of the profit gap, the 1975-1984 period saw a big shift in industrial structure to the processing type, that is, to the light and soft type. Moreover, this change tended to be accelerated in the latter half of this period.

This structural change was an inevitable current of the times. Industrial structure undergoes constant change, with change in social structure and the industrial environment as background. This is proved by history.



Changes in the Index of Ordinary Profit (With the Index in 1973 as 100)

Key:

1. Index
2. Changes in the index of ordinary profit (with the index in the March term of 1974 as 100)
3. (Note 1) The basic materials industry showed a deficit in the March term of 1976
4. (Note 2) The indices were calculated by successively multiplying them by the rate of increase or decrease in profit compared with each preceding term
5. Basic materials: Fiber, paper/pulp, chemicals, waste/soil, iron and steel, and non-ferrous metals
6. Processing: machinery, electric machinery, automobiles, transportation equipment, and precision machinery
7. Processing industry
8. All industries
9. Manufacturing industry
10. Basic materials industry

The industrial structure for advanced industrialization, centered on the traditional heavy-type industries which bloomed from the latter half of the 1955-1964 period, entered the age of maturity from the latter half of the 1965-1974 period. When something reaches the stage of maturity, a new trend begins to take form. It can be said that the maturity of the highly industrialized society made the shift to the highly informationalized society inevitable as the next step.

A situation promoting such an inevitable current of the times occurred at the end of the 1965-1974 period. Needless to say, it was the oil crisis.

It goes without saying that the Japanese industrial structure in terms of advanced industrialization was based on the environment enabling Japan easily to obtain large amounts of resources including inexpensive oil.

However, the resources environment underwent a complete change, with the oil crisis as the turning point. There arose the necessity of changing the industrial structure to one which conserves resources and energy.

The industries of the traditional heavy type consume large amounts of resources. They are unable to become leading industries in the resources-saving age. A change of industrial structure to a resources-saving structure of the light and soft type is necessary even as a national policy, and it can be said also that it was an urgent task.

In this situation, social needs are beginning to follow rapidly the direction of shifting to software, services, and information. This direction also has accelerated the change to an industrial structure of the light and soft type.

It can be said that such moves in the 1975-1984 period brought about such results as the high growth of the industries of the light and soft type and stagnation of the industries of the traditional heavy type.

Traditional Heavy-Type Industries Pressed to Change Course

The possibility is strong that the change in industrial structure will speed up further from the start of the 1985-1994 period.

Over the 1975-1984 period the industries of the traditional heavy type acquired the greatest competitive power in the world, and they have been able to be active in the international market backed up by this power.

However, the arena of their activities is being narrowed for two reasons. The first reason is the narrowing of their domestic and overseas markets. In the domestic market, the age of high-rate growth has already come to an end, and they have plunged into the stable-growth economy. The schema of mass production and mass sales, which was a symbol in the age of high-rate growth, is becoming impracticable. Social needs have become diverse, and people have come to seek quality rather than quantity. As to needs for goods, too,

importance has come to be attached not so much to the goods themselves as to software and know-how added to the goods.

On the other hand, their overseas markets are also tending to dwindle gradually due to the constant problem of trade friction. In addition, the competition from developing countries is acute. Such countries as the Republic of Korea, Taiwan, and Brazil are acquiring great power with their industries of the traditional heavy type. The cases where imports of manufactured products from these developing nations oppress the domestic market due to the so-called boomerang effect are seen in iron and steel, too, which have strong international competitive power.

In view of this situation, it has become difficult for the industries of the traditional heavy type to follow the expansion trend of the past.

In the final analysis, the situation is being brought about in which we inevitably think that business conditions will continue repeatedly to rise and fall, not going beyond the cycle of the business cycle.

All the more for this reason, the biggest task of the industries and enterprises of the traditional heavy type throughout the 1985-1994 period is to break out of this cyclical type of industry and also to change course from the traditional heavy type.

Unless enterprises of the traditional heavy type find a direction for new growth, even aside from their course, and think of shifting in this direction they will finally have to trend the path of decline. This is recognized most distinctly by enterprises of the traditional heavy type.

Therefore, it is necessary to watch the enterprises of this type carefully, to see what path each of them is beginning to follow to change its course. In the stock market, this has become a big clue to groping for the future of these enterprises.

Various Directions of Shift

Enterprises of the traditional heavy type have various ways of tackling the business shift. The present situation is that they are starting work on it while taking note of all future possibilities.

When these ways are pigeonholed, it is possible to classify them in some patterns. The first pattern is a direction of shift "focused on advanced technology."

This direction is based on their close attention to the current of the times which shows that the most important fact for future business growth lies in the development of technology. Thus they intend to direct their energies to three kinds of advanced technology which constitute the axis for renovation of technology in the future.

Needless to say, the three kinds of advanced technology are electronics, biotechnology, and new basic materials. It is not too much to say that there are no enterprises of the traditional heavy type which are not tackling any of these fields of advanced technology. It can be said that this is a typical pattern of changing course.

The second pattern is advance into the "fields of software and services." This is based on the idea of effectively using the technological assets accumulated in the past. It can be said that these assets are represented by such fields as systems engineering, real estate, and information services.

In any of these patterns, there are few cases of shifting to entirely new fields. After all, they focus on extending the traditional lines of business. A shift in business is based on the existing business. Any change of course will be ineffective unless it makes possible the effective use of what has been cultivated with the existing business.

At any rate, enterprises of the traditional heavy type are showing vigorous moves, with a view to reviving their power of growth by changing course. As to which moves will bear fruit, only time will tell.

However, it is necessary to note that the industrial map will change gradually as a result of such shifts. The number of enterprises which cannot be judged by the traditional industrial classifications will increase gradually.

It should be borne in mind that evaluating individual enterprises by traditional industrial theory may possibly result in a mistaken evaluation.

Changes of Enterprise Groups

There are not a few enterprises already showing differences between their past enterprise images and their actual situations, as a result of changing course. They include Meiji Seika Kaisha, Ltd., Nippon Kayaku Co., Ltd., Ibiden Co., Ltd., and Toyojozo.

Meiji Seika has a strong image as a confectionery manufacturer, but its business status is rather that of a manufacturer of medical supplies centered on antibiotic materials. Toyojozo was a liquor manufacturer, but actually the importance of its medical supplies is great. Ibiden gives a strong impression of being a carbide manufacturer, but it is already transforming itself into a new basic materials manufacturer emphasizing electronic materials.

It is anticipated that many such cases will appear in the future from among enterprises of the traditional heavy type, but it will take some time.

Traditional heavy type enterprises belong to a group of industries such as textiles, chemicals, cement, iron and steel, non-ferrous metals, and shipbuilding, which used to be support and driving forces of heavy and chemical industrialization. These enterprise groups are actively carrying forward moves to change course.

In the field of textiles, Kanebo Ltd.'s change of course is typical with medical supplies, cosmetics, and foodstuffs constituting the axis. This company is followed by such enterprises as Toray Industries, Inc., Teijin Ltd., Asahi Chemical Industry Co. Ltd., Toyobo Co. Ltd., Unitika Ltd., and Kuraray Co. Ltd., with new basic materials and medical supplies as the axis. Also, Toho Rayon Co. Ltd. is shifting to new basic materials, and Mitsubishi Rayon Co. Ltd. is advancing into the new basic materials and electronic fields. They are embarking upon the cultivation of new fields in a colorful, positive way.

In the field of chemicals, the results of the shift have come to be largely connected with actual profits, as in the cases of Kyowa Hakko Kogyo Co. Ltd., Kureha Chemical Industry Co. Ltd., and Shinetsu Chemical Co. Ltd. Probably Sumitomo Chemical Co. Ltd., Mitsubishi Chemical Industries Ltd. and Showa Denko K.K. will be noted as to their future trends. This is because they are multilaterally carrying forward their moves to change course.

In chemical industry circles, moves to change course are vigorous and extend over a wide area. Various enterprises are active over a wide range, including biotechnology, electronics, new basic materials, and real estate.

Advance into new fields, based on chemical technology, is active, as can be seen from the creation of such words as bio-chemical and electro-chemical.

Besides the above-mentioned enterprises, there are many enterprises to be noted, such as Mitsui Toatsu Chemicals Inc., Toyo Soda Manufacturing Co. Ltd., Nissan Chemical Industries Ltd., Ishihara Sangyo Kaisha Ltd., Denki Kagaku Kogyo K.K., Mitsui Petrochemical Industries Ltd., Daicel Chemical Industries Ltd., Central Glass Co. Ltd., Tokuyama Soda Co. Ltd., Nippon Oil & Fats Co. Ltd., and Japanese Geon Co.

As to cement, all cases of shift are centered on changes based on new ceramics. They are based on cement-calcination technology. It is probably necessary to follow the future courses of Onoda Cement Co. Ltd., Nippon Cement Co., Ltd., and Mitsubishi Mining & Cement Co., Ltd.

In regard to iron and steel, we want to watch closely the future courses of the six blast furnace companies including Nippon Steel Corp., which can be said to be a symbol of enterprises of the traditional heavy type. It is necessary to note how they will utilize their assets, know-how, and talented persons, all the more because their potentials are great.

In the case of non-ferrous metals, various companies are beginning to devote their energies to the fields of electronic materials and rare metals by using their refining and metal-processing technology.

We want to watch the outcome of changes by Dowa Mining Co., Ltd., Mitsui Mining and Smelting Co., Ltd., Furukawa Co., Ltd., Nippon Light Metal Co., Ltd., etc., not to speak of Mitsubishi Metal Corp. and Sumitomo Metal Industries, Ltd., which are producing actual results.

In the field of shipbuilding, which involves not only the processing business but is also an industry of the traditional heavy type, Mitsubishi Heavy Industries, Ltd. is already showing satisfactory results from its change of course, but this has yet to develop fully. With Ishikawajima-Harima Heavy Industries Co., Ltd. and Kawasaki Heavy Industries, Ltd. added to that company, how will their abilities be displayed in new fields?

Let us take up main companies from among the above-mentioned enterprises and predict their changes 5 years hence to see how their shifts in position will appear.

Toyobo Co., Ltd.--Aiming at 50 Percent Profit From Non-Fiber

This company is a prestigious enterprise which has always been positioned as a leading presence in the textile industry which has supported the economic development of Japan both before and after the war. Since the first oil shock, however, even this distinguished enterprise has been unable to free itself from a predisposition resulting from the structural depression, and the age when it was called a "sleeping lion" has continued for a long time.

Now this "lion" is waking up. In other words, it has departed from its business development centered on textiles, which is the product it has been handling since its foundation. Thus it is pushing forward the expansion of non-fiber business. For the past several years various textile companies have been endeavoring to expand their on-fiber sectors as a survival measure. In the case of Asahi Chemical Industry Co., Ltd., for example, the ratio of non-fiber production has already reached 72 percent, and it is improving rapidly. In contrast, the rate in Toyobo Co., Ltd., was only 16 percent (April term, 1985), and it lagged far behind Asahi Chemical Industry, etc.

The non-fiber sector of this company is devoted to new enterprises for plastics consisting mainly of packaging films, enzymes, active carbon fibers, and electronic equipment (electronic parts, production of which is entrusted to Cosmo Electronics Co., a subsidiary of Toyobo Co., Ltd.).

Current sales in the plastics business of this company account for about 80 percent of its total sales in the non-fiber sector, and these sales bring about most of its profit. Above all, it takes pride in having top share of packaging films.

In this field, the company in 1984 established "Nippon Magphane Co., Ltd." with Rhone Poulenc of France by sharing investment with it on a 50-50 basis, and started production of films for magnetic tape. In addition, it is carrying forward the development of films for flexible circuit boards and polarized light films. As to products connected with resin, it is monopolizing polyester elastomer (elastic body) for engineering plastics, in addition to nylon photosensitive resin plates, and it is achieving good results in terms of PET bottle resin. However, the amount of sales is small.

Creation of a Third Pillar

New enterprises will play a role in the future non-fiber sector together with such plastics businesses. The yearly business in these enterprises is as yet less than Y10 billion, but the profit rate is high. In addition to working to expand its present biotechology business, AC (air-purification equipment using active carbon fiber) and functional films, it will have new access to fields related to electronics and information. Thus, its policy is to carry forward commercialization in these fields in a positive way as a third pillar of management along with textiles and plastics.

What is being noted recently in the field of new enterprises is enzymes. Besides increasing the number of species, with limited enzymes for gene recombination as the mainstay, it has advanced into the high-tech field, too, on the basis of this enzyme technology. It is thus tackling studies on new thrombus-dissolving agents in cooperation with Integrated Genetic Corp. of the United States. In the medical field, too, it is developing such medical materials as chemical reagents for clinical examination, hollow fiber films for blood purification, and anti-thrombus materials. Thus, many promising commodities are vying for position.

This company, putting up a "1990 vision," seeks to achieve sales of Y500 billion and ordinary profits amounting to Y30 billion in 1990, the final year. It plans to increase the ratio of such non-fiber items to 35 percent of sales and to 50 percent of profits at that point in time. For this purpose, it is planning to give priority to its non-fiber enterprises and make facilities investments running up to Y130 billion to Y150 billion during the 7 years prior to 1990. It is expected that the company will transform itself into a compound advanced enterprise in the future.

Teijin, Ltd.--Pharmaceutical Business Reaches Growth Phase

This company's development of pharmaceuticals is being given a greater impetus than ever, with the catch phrase "Let us not imitate anything and stop doing what others do."

In 1973 the company advanced into the pharmaceutical business as part of its diversification policy. This is because it finally moved into the black after a lapse of 10 years and established its business foundation.

The pharmaceutical business of this company has grown to the extent that its sales in 1984 exceeded Y16 billion, including eight pharmaceutical items for medical doctors, general medical supplies, and medical equipment including artificial kidneys and diagnostic equipment. These items are supported by two mainstay goods--VENILON for the manufacture of globulin, a medicine to cure serious infection, and ONE ALPHA for chronic renal insufficiency--which bring a total monthly sales of Y1 billion.

Under its 3-year management plan ending in 1985, it took up as its business tasks such points as fostering its pharmaceutical business, expanding its

chemical business, and strengthening the make-up of its textile business, and it has been pushing forward these tasks. It has the prospect of achieving its ordinary profit target of Y30 billion. In accordance with these prospects, the company will start a new 3-year plan from 1986, and at the same time it will come up with a 10-year vision forecasting the situation 10 years hence. Thus its management posture is also being elevated further.

The noteworthy 10-year vision is scheduled to be announced in January 1986. However, the basic stance has been generally firmed up, and the vision will be formulated under the following five major policies: 1) continuous prior investment in pharmaceutical business; 2) expansion of chemical goods production; 3) qualitative improvement of fiber; 4) development toward new business; and 5) increasing of production efficiency.

Profit Makeup Will Undergo a Big Change in the 1985-1994 Period

The company is planning on strongly pushing forward its pharmaceutical business, in particular. It has been fostered as the third pillar of management next to fiber and chemical products. However, as it has made a take-off as an enterprise, the company is planning to increase further both sales and profits.

As a matter of fact, we can see how it is making efforts for its pharmaceutical business because it has drawn up an independent 3-year plan (1985-1987) for this business.

It has already completed its research and development structure, too, the way regular pharmaceutical enterprises have done, as can be seen from the fact that it has a Safety Research Center and a Radioisotope Center. Thus it stands ready further to accelerate the development of new medicine. Incidentally, the company is training its sights on medicine for circulatory diseases and anti-cancer medicine by using biotechnology, including cell fusion and gene recombination, with close study of physiological activators as a target.

It intends to promote direct sales, too. Until last March its salesmen covered about 100 hospitals in Tokyo and three prefectures, but after April it tripled the number of hospitals to be covered to 300. It plans to increase the number by 50 percent across the nation in 3 to 4 years, and by 100 percent 7 years hence. This is designed to cope with the future possibility of rapid progress in keeping an assortment of goods in stock.

Now the company is developing six items including artificial saliva, a medicine to cure nasal allergy, another against broncho-dilation, and still another to cure extensive inflammation of the oral mucosa. It has made application concerning these six items, including change of medicine types. In addition, it is conducting clinical examinations of anti-rheumatism medicine, anti-ulcer medicine, etc.

Especially the latter two kinds of medicine are expected to bring a total yearly sales amounting to a large sum of money--Y10 billion. It is anticipated that the battle lines will be drawn in 1989 or 1990. It is viewed as certain that the profit structure of the company will undergo a complete change, with this highly profitable pharmaceutical business coming into full flower.

Toray Industries, Inc.--Success Depends Upon Cultivation of Demand for Carbon Fiber

This company is pushing forward a management plan aimed at obtaining in 1986 more than Y700 billion in sales and Y50 billion in ordinary profit. In the meantime, it is developing positive management including facilities investments amounting to Y50 billion annually.

In the field of fiber, it is working for an investment in the machinery sector, accompanying the scrap and build of nylon long-fiber facilities, for the increasing of tire cord (nylon) efficiency, and for the renewal of polyester long-fiber facilities. On the other hand, it is making a considerably investment to establish a non-fiber sector as a pillar for the future.

It is expanding the currently highly profitable polyester film plants in Shiga and Mishima, to produce 500 more tons total per month. It is also strengthening its engineering resin plant. It is expected that these efforts will result in a marked increase in demand for these products for VTR's and extremely thin and ultra-precise items including computer printer ribbons.

As to new enterprises, it is planning to increase production of reverse osmotic membranes by 35 tons (in terms of the amount of permeating water) per month, with the rapid increase in the production of these films, which are used for the manufacture of semiconductors, as a background. In the case of carbon fiber, it is scheduled to achieve growth of more than 20 percent per annum in the future, too, by using testing facilities, etc., in order to improve its technology development. The ratio of production in the non-fiber sector is about 35 percent at present. But the company plans to raise it to 50 percent at the end of 1987 and to 60 to 70 percent 5 years hence.

Carbon fiber, the facilities for which have an annual output of some 1,500 tons, the largest in the world, is likely to answer in the future, too, the greatest quantitative expectations in the non-fiber sector. This fiber is centered on the PAN [polyacrylonitrile] polyester group. In our country; 80 percent of the total output of this kind of fiber is used for sports and leisure purposes, including tennis rackets and golf clubs. In the United States and Europe, 50 and 40 percent are used, respectively, for aeronautics and space purposes.

Let us take the Boeing 767, for example. About 1 ton of carbon fiber, resin, etc., is used for the tail of one plane of this type. Of this, about 500 kilograms are the weight of carbon fiber. When compared with the total weight

(105 tons) of one plane, this is a small quantity. But there is a trend for its gradual use also for primary structural materials for the wing and fuselage.

There is a strong probability that exports of carbon fiber for aeronautical and space purposes will increase rapidly through improvement of the strength of carbon fiber itself, the strength of prepreg (intermediate material with carbon fiber impregnated with regin); and the quality of mixed resin.

A Third Pillar: Pharmaceutical Business

Expansion of the pharmaceutical sector is also a focal point, in addition to the development of composite materials reinforced by carbon fiber. Some time ago the company received approval to manufacture "feron," an anti-cancer medicine containing interferon of the beta type as an ingredient. It has completed the recording of the prices, and it will put this medicine on full-scale sale this autumn. As it is to be used for skin cancer, part of a cerebral tumor, etc., the yearly sales will conceivably amount to Y5 billion when it reaches the peak. Commercialization of the anticancer medicine containing interferon is noteworthy.

Furthermore, the scope of medical effects of "feron" will expand, followed by sales of new kinds of medicine. Thus the earning power of the company will increase further. The number of technicians has increased from the 100 of 40 years ago to 2,000, including those working at the research laboratory, various plants, and the engineering sector. The structure to cope with an age of "new chemistry," which the company is aiming at, is expected to be on the right track 5 years hence. The structure is being readied to pre-empt an age when chemistry and electricity, and biotechnology and chemistry are combined.

Kuraray Co., Ltd.--Industrial Materials and Non-Fiber Sectors to Be Expanded

An impetus is being given to expansion of the non-fiber sector. The non-fiber sector of this company consists of chemical products and medical equipment. Especially the chemical products are centered on what this company has developed ahead of other companies in the world, and all these products are enjoying an overwhelming share in Japan.

Clarino, for example, which is artificial leather, was put on the market by the company in 1964. Since then it has repeatedly improved its quality, and now it can substitute for all goods made of natural leather. The technical level of this product is high, and Du Pont of the United States also moved into the field of artificial leather at one time, but it retreated in the face of Kuraray's technical level. The present amount of production by this company is 8.4 million square meters per annum. In terms of oxhide, this corresponds to that of about 2 million cattle per annum. As to bags, knapsacks, golf shoes, camera cases, etc., the artificial leather of this company has secured a share of 50 to 70 percent of the total artificial leather products, and it is one of the pillars of its non-fiber sector. Its

policy is to increase its annual production to 9 million square meters in the near future.

Running Ahead Alone in the Field of EVAL Resin

Another pillar for the source of profits in the non-fiber sector, ranking with artificial leather, consists of POVAL and EVAL resin. The output of POVAL in Japan accounts for about 60 percent of the world total and this company is Japan's top-ranking POVAL manufacturer with a share of 50 percent in Japan. This resin melts in water and readily turns into threads or films. The market for this product is expanding smoothly, with its extensive uses for gum tape, adhesives for stamps, and packaging films.

EVAL was born of the production techniques for POVAL, and it was successfully industrialized for the first time in the world. It is a new basic material attracting attention both at home and abroad. This resin film has a close molecular structure, and its capability to intercept oxygen is extremely high. For this reason, it can prevent qualitative change and decomposition of foodstuffs, and therefore it is enjoying rapidly increasing demand as a material to package ham, miso, mayonnaise, tea, and confectionery. The profit ratio is high, its domestic share amounts to 90 percent, and the company is unchallenged.

Medical Instruments Constitute the Nucleus

On the other hand, one promising commodity after another is now seen in the medical business of this company. The sales in its medical sector are now a little less than Y10 billion. By sectors, the sales of artificial internal organs account for 50 percent, disposable medical instruments 30 percent, dental materials 15 percent, and electronic medical instruments and soft contact lenses 5 percent. The company plans to more than double the sales of all these goods to Y20 billion in 1989.

The star items among these products are disposable medical equipment, special eyeglasses, etc. The company is scheduled to increase rapidly the sales of medical instruments to 35 percent of its total sales of medical equipment, on a medium-term basis, for the time being. Its policy is to move into pharmaceuticals and diagnostic medicine during the next 5 years, thereby expanding its medical business rapidly and fostering it as a big pillar of its non-fiber sector.

This company is putting up its "1990 vision" in an effort to shift to an expanded balance line. In this vision the company sets its sales at Y400 billion and its ordinary profit at Y16 billion to Y20 billion. In concrete terms, it will expand its non-fiber business and new enterprises, making its self-renewal as a general chemical company its basic strategy. It intends to raise the non-fiber ratio from the present 30 percent to 50 percent in 1990.

Sumitomo Chemical Co., Ltd.--Advance Into Seed Business

This company, which has outstanding real ability in Japan in its ability to develop agricultural chemicals, has recently begun to make strenuous efforts for the development of biotechnology connected with agriculture. It enjoys an established reputation for its technological power for such fine chemical products as pharmaceuticals, agricultural chemicals, new basic materials, and electronic materials, and its sales of these products account for 30 percent of its total sales. It aims at achieving a sales ratio of 50 percent in the future, and biotechnology is the field serving as motive power for this purpose.

The company started production tests on tissue culture of virus-free seedlings at its Misawa Plant in Aomori Prefecture.

It has also started the cultivation of hybrid rice and wheat as a preliminary for the development of new biotechnological species. Thus it has a preferential position in Japan as to biotechnological strategy for agriculture, too. It is taking such positive measures as to move even into the seed business and deal with grain, too, by concluding a tie-up contract with Rohm & Haas Corp., a major U.S. chemical company, in January this year.

Rohm & Haas Corp. is one step ahead of the company in the method of developing hybrid rice plants by using the male sterilization agent. All the more because of this, it can be said that through the tie-up the company has completed a structure enabling it to cope fully with the joint development of artificial seeds by Kirin Brewery Co. (which has a tie-up with Genentech of the United States).

In April this year it already developed "Kippo No 1," a new kind of rice. It is expected that with this as a mother species, impetus will be given to the development of hybrid rice by using the male sterilization agent, and on the other hand, that its seed business will expand further.

Advance Also Into Bioreactor Business

In addition, its studies on bioreactors and biotechnological studies on pharmaceuticals are making progress. In regard to bioreactors, the company has obtained prospects for the production of new insecticides. It is scheduled to operate in the coming autumn a commercial plant by the batch formula to treat materials collectively for each fixed quantity, and shift to a continuous production formula by using fixed enzymes. The bioreactor, which is a product of basic techniques based on biotechnology, is used for amino acid, etc., and this is an opportunity to expand the field of application.

Variegated New Projects

Regarding pharmaceuticals, merchandising such items as alpha-type interferon (factor to restrain virus multiplication), which was introduced from Welcome Corp. of the United States, is entrusted to Sumitomo Pharmaceutical Co., a

subsidiary, and the products independently developed by the company are limited for the present to a chemical reagent for which a monoclonal antibody is used. As to development of pharmaceuticals, it seems possible to say that things will become definite in the next 2 or 3 years.

The company is rapidly expanding to new fields including fine chemical and biotechnological products. In its new fields, it is planning to increase its sales to Y150 billion in the December term, 1990 (Y11.9 billion in the December term, 1984) with its long-term management strategy formulated in 1984.

For this purpose, the company changed its articles of association at the shareholders' general meeting in March, and added more than 30 business items including the high-tech fields.

This will enable the company to tackle full-scale development of its new projects. They are represented by optical discs, alumina fiber, multilayer ceramic condensers, EL lamps, and agri-business (such as registration of new kinds of rice) based on the agricultural chemicals sector, in addition to biotechnological products. Thus the projects are extremely varied.

It is expected that 5 years hence the company's inclination toward becoming a high-tech enterprise will become clearer than ever, and that it will enter a leap-forward stage, from the viewpoint of business achievements, too.

Mitsubishi Chemical Industries, Ltd.--Taking the Lead in the Field of Biotechnology

At this time when one enterprise after another is moving into the fine chemical field, mostly major general chemical enterprises, this company's positive measures are conspicuous. Under its plan, it has come up with a management strategy designed to raise the component ratio of sales of highly functional goods to more than 30 percent by the year 1990. It is carrying forward research and development of biotechnology, information and electronics, new basic materials, etc., and facilities investments.

The motive power to push forward this higher function strategy must depend upon profits from the carbon business centered on coke, and from the petrochemical business. The sales in the petrochemical business amount to some Y320 billion, constituting about 40 percent of the total sales. If this sector goes into the red, as it did 2 or 3 years ago, the company will inevitably have to revise its strategy for higher functions.

To strengthen the make-up of its petrochemical business, therefore, the company is scheduled to establish a plant annually producing 200,000 tons of high-purity terephthalic acid, and to set up a Mitsubishi Chemical Vinyl Co. by obtaining all the stock of Monsanto Chemical Vinyl Co., thereby solidifying the foundation of this business through investments exceeding Y20 billion when those in the two establishments are combined.

On the other hand, the company is enthusiastic for increasing the sales of high function goods. These goods are roughly divided into biotechnological products, new basic materials, and information/electronic items. Especially conspicuous is the way it is tackling biotechnology, which is said to be the giant technology of the 21st century. In 1971 the company established the Mitsubishi Kasei Institute of Life Sciences, which is Japan's first full-scale biotechnological basic research institute.

The number of biotechnological patents held by the company at present is the largest in Japan. It is also planning to invest about Y10 billion in the development of biotechnology and pharmaceuticals out of the Y26 billion for research and development in the current January term.

Aiming to Become a Leading Pharmaceutical Enterprise in the Next Generation

Current sales of pharmaceuticals are still small, but the new pharmaceuticals to be developed by this company in the future will be of many kinds. Starting with THEODUR, a medicine for asthma which was put on sale last year, the company is scheduled to apply this year for the sale of an agent to improve liver functions and a medicine for senile dementia, and to apply for the sale of a medicine for cerebral thrombosis in 1986. It is expected that all these pharmaceuticals will be brought along as large-scale production goods bringing a yearly turnover of some Y10 billion at the peak.

As to new pharmaceuticals to which biotechnology is applied, the company is moving ahead with the development of TPA, a thrombus-dissolution agent, and with human serum albumin. It is scheduled to enter the battle line in a few years. In the field of plant biology, it is carrying forward the development of new products by setting up a Plant Engineering Research Institute in cooperation with Mitsubishi Corp.

The company's initiation of its first joint study on the improvement of rice plants with the Ministry of Agriculture, Forestry & Fisheries in January this year shows the sophistication of the company's technological power. The company, which has thus been accumulating basic techniques concerning biotechnology, with life sciences as a theme, is now trying to accelerate the development of goods with a view to becoming a leading pharmaceutical enterprise in the next generation.

The sales in the field of biotechnology and pharmaceuticals amounted to only Y3 billion in 1984, including those for medical treatment. However, it is aiming at Y110 billion 5 years hence. It is likely that new biotechnological pharmaceuticals, to which the company is directing its greatest energies, will also join such pharmaceuticals on the market by about 1990.

There is also the probability that the company will carry out operations to use and purchase Tokyo Tanabe Co., Ltd., Nippon Shinyaku Co., Ltd., in whose capital the company is participating, while aiming at expanding its profits in the field of biotechnology and pharmaceuticals. The outcome of these undertakings by this company, which aims at landing on the new biotechnological

continent by putting pharmaceuticals in the forefront, is likely to determine whether or not it will transform itself into a high profit enterprise.

Daicel Chemical Industries, Ltd.--500,000-Disc-a-Year Structure to Be Established

This company is pushing forward its third 4-year mid-term management plan ending in the year 1988. Under this plan the company is anticipating high growth, estimating sales in the final 1988 business year at Y250 billion and ordinary profit at Y18 billion.

The point during this period is to expand demand for optical magnetic discs and optical discs capable of recording, reproduction, and erasure, which are regarded as prospective ultra-big-capacity media in the information age and will be commercialized on a full scale within this year. In July last year the company announced its entry into the optical disc market. What the company is to manufacture is said to be of the "EIDRAW type" among optical discs, and it is characterized by its capability in effecting recording, reproduction, and erasure.

The company has a forte for polycarbonate resin which is used for the base of optical magnetic discs, and also for recording films and for protective films covering the base. The company mastered the techniques in less than 3 years partly due to guidance given by KDD (Kokusai Denshin Denwa Co., Ltd.), which has a basic patent for recording films. The completed product is one disc 30 centimeters across which accepts 60,000 sheets of A4-size documents, and has a recording capacity about 1,000 times that of FDD (floppy disc).

From late last year the company started, at the Harima Plant (Hyogo Prefecture), construction of facilities capable of producing 500,000 optical discs and optical magnetic discs annually, and it completed the construction in late August this year. It will start delivery to users in November.

There are brisk inquiries mainly from the United States, and an increasing number of companies are likely to conclude contracts with Daicel, in addition to several companies which have already entered into contracts. But in regard to optical magnetic discs capable of rewriting, the company judges that it will still be a long time before they enjoy full-scale demand. Therefore, its policy is to stop at drawing up a facilities plan for these discs, and to give priority to optical discs which are to be used exclusively for read, for the time being.

For this reason, it is viewed that inquiries will be centered on those for large-capacity data filing for computer memory, and for stationary images. It will start full production of 500,000 discs (13-20 centimeters in diameter) at the beginning of autumn next year.

Profit Structure Will Change Rapidly

The sales target for optical magnetic discs is set at Y10 billion in 1988. There is a tentative calculation that the optical disc market will expand to a scale of some Y5 trillion throughout the world 5 years hence. Therefore, it can be fully expected that there will be demand about twice that envisaged in the plan, even as a conservative estimate.

In addition, the company is developing electroconductive panels and transparent electroconductive films. Thus, electronics is a star item of the company at present. "Chemitronics," which fuses electronic materials and chemistry, is already a new objective, and it is regarded as certain that it will grow into a profitable pillar several years hence.

Incidentally, the ratio of new goods to the total profit already reached one-third in the preceding March term. The company plans to increase this ratio to 50 percent 4 or 5 years hence. It can be said that this is not too big a target, because what has so far been sown has put forth buds and is nurturing steady growth of promising high-profit goods.

In addition to such electronic materials as optical discs, there are many items which the company has developed, such as peracetic acid derivatives, chlorinated products, and deodorants. It will strengthen its business foundation by means of organic synthesis and cellulose, which comprise its existing sectors, and foster its new business which has pre-empted the current of the times. Thus it will transform itself into a representative enterprise bringing higher profits among the Japanese chemical enterprises of medium standing.

Nihon Cement Co., Ltd.--Positive Development of Tie-Up and Joint Management

The cement business circles, which are facing the structural depression, are tackling their line of diversification with desperate efforts, staking their life and fortune on survival. The diversification line of major cement companies is centered on new ceramics which uses their special sintering techniques. Their recent advance into fields having nothing to do with cement, such as information processing and electronic measuring instruments, is conspicuous. This shows their frantic efforts to grasp a foothold to move toward growth fields at any cost.

This company is a typical example of such efforts. In 1984 it tied up with A&D Co., a venture business handling such electronic measuring instruments as electronic balances, and embarked upon joint development of industrial measuring instruments. A&D is a venture business showing rapid growth with electronic balances, weight indicators, electronic measuring instruments and all sorts of converters. Especially as to electronic balances, it is a major enterprise in the business ranking with Shimadzu Corp. The company is affiliated with Asano Seiki Co., a manufacturer of special balances for heavy industry. However, it is trying to expand its measuring instrument field further and to develop new products by making the most of the development

capabilities of the three companies on the basis of A&D's electronic technology.

In addition, its joint development with major manufacturers has become active recently. It is developing ROCK BOLT, a fixing agent to prevent landslides, jointly with Shimizu Construction Co., Ltd., and "TETRAGUARD," a highly efficient agent to reduce contraction, jointly with Sanyo Chemical Industries, Ltd. Especially "TETRAGUARD" is an epochal mixing agent to prevent dryness and cracks arising in concrete structures. This is the first to be manufactured in the world. It is a new product requiring 8 years for development, and it has enhanced the reputation of the company as the "Nihon Cement of Technology."

Tackling New Ceramics on a Full Scale

The diversification line of this company has been conspicuously lagging behind that of other companies engaged in similar business, but it has accelerated recently. This can be seen in its full-scale entry into the field of new ceramics. In July 1984 it started trial sales of humidity sensors, and it has recently developed many kinds of fine ceramics raw materials and products such as alumina, silicon nitride, and sialon. Thus, it has moved into this field on a full scale.

The alumina developed by this company has a high abrasion-resistance, high heat-resistance, and a highly mechanical feature. The company is aiming at using it for abrasion-resistant liners, heat-resistant parts, pump parts, and mechanical seals. Moreover, it will work for diversified uses of silicon nitride and sialon, and direct its energies to all sorts of measuring instruments, including humidity sensors.

Also, the company sought out capable persons from Nippon Ceramics Co., a venture business handling electronic parts, in order to expand the scope of the ceramics business, and it has established a subsidiary named "Megacera." This effort to hunt out capable persons is designed for a rollback to promote its new ceramics business, which has been lagging behind that of other similar companies. It intends to make full-scale entry this autumn into the field of electronic parts including speakers and buzzers for which piezoelectric ceramics is used. It is planning to have Megacera achieve annual sales amounting to Y1 billion 3 years hence.

Thus, the diversification line of this company has finally reached a full-dress stage, and it is likely that "New Nihon Cement" will be born 5 years hence.

Nippon Steel Corp.--Advance Into "Light and Soft" Business

This company is the biggest iron and steel manufacturer in the world, having an annual crude steel output of 27,000,000 tons, twice that of U.S. Steel which ranks second. However, it is difficult for this company to expect its business achievements to take a leap forward based on iron and steel alone

amidst the world-wide leveling off of steel demand, so it is beginning to push forward new management measures in a positive way.

At the regular shareholders' general meeting in 1983, it changed its articles of association concerning business purposes and added a new item to the effect of "manufacturing and selling non-ferrous metals, ceramics and chemical products." This was intended to achieve positive advance into the field of new basic materials in the future. Thus Nippon Steel Corp., which has a big potential, came up with a policy of positively embarking upon business of the "light and soft type" away from the business of the "traditional heavy type."

Its shift to the status of a general basic materials manufacturer is to be effected by concentrating the total power of the Nippon Steel Corp. group, including its technology and sales, and there is the strong possibility that it will give rise to greater driving force than ever. It has so far carried forward research and development of chemical products and new ceramics under the lead of its Technology Research Institute, but there have been many cases where related companies carried out industrialization of these items separately. In a word, it was under a vertical division-of-labor system. In the future, however, it will work for the development of new business under a matrix system including horizontal tie-ups.

In the Nippon Steel Corp. group there are a little more than 700 companies whose stocks are held by this corporation. Of them, about 170 major related companies are keeping close cooperative relations with the corporation. The total capital of this group is about Y300 billion, comparable to Nippon Steel Corp.'s capital of Y330 billion. The actual sales of this group amounted to some Y6.4 trillion in 1983 and the total number of employees was more than 120,000. Thus the group is about twice as large as Nippon Steel Corp. in both sales and the number of employees.

Inclined Toward the Non-Steel Field

By concentrating the overall power of this group, the corporation merged Nippon Steel Chemical Co. with Nittetsu Chemical Industry Co. in April 1984, and created "Nittetsu Chemical Co., Ltd." as a focus for measures to expand its new business. Due to this, an integrated structure ranging from tar distillation to the production and sales of final products was established, and development of such new materials as carbon fiber and composite materials and development of new business have become more flexible.

Of the total sales in 1983, amounting to Y9,071,200 million (including Y2,659,700 million on the part of Nippon Steel Corp.), the sales in the non-steel sector already accounted for 37 percent, showing a fairly big increase from the 31 percent in 1973, 10 years ago. Through development of the group strategy in the future, the corporation will further strengthen its inclination toward the non-steel sector.

In regard to profits, too, the policy of the corporation is to earn 40 percent of the total profit in the non-steel sector 5 years hence.

As mainstay products, Nittetsu Chemical Co. will produce carbon fiber centered on the pitch group. In addition, in the chemical business alone for artificial graphite electrodes, rocket nozzles, etc., the group estimates its annual sales 10 years hence at Y400 billion (Y150 billion in 1983). Of this amount, it is planning to earn Y300 billion from coke distillation and other projects which Nittetsu Chemical Co. is tackling, and Y100 billion from new basic materials including carbon fiber.

As to fine ceramics, magnetic materials, titanium, amorphous materials, electronic materials, etc., the corporation aims at achieving big sales 10 years hence, on a long-term basis. Even 5 years hence, both the sales and profits in the non-steel sector of the group will reach nearly half the total, and therefore its earning capacity will improve further.

Kawasaki Steel Corp.--Taking the Lead in C_1 Chemistry

Japan Iron and Steel Federation Chairman Saito emphasized in his New Year greeting that, "This is a year for the iron and steel industry circles to work for their constitutional improvement and at the same time to tackle the supply of new basic materials meeting the needs of the advanced information society." A new age is approaching in the world of iron, too, as can be seen from the fact that strategy for new basic materials has been announced even by this person, noted for his bullish sentiment, that iron is eternal.

In the spring of this year, this company and Nippon Steel Corp. have already decided to move into the semiconductor wafer (substrate) business, one after the other. Sumitomo Metal Industries, Ltd., a related company handling wafers, lead frames, etc., has adopted the policy of commercializing even semiconductor-manufacturing equipment.

Among such offensives to advance into the high-tech field, those toward business for new basic materials are most conspicuous, and the star items of the five major blast furnace companies include ceramics, amorphous metals, carbon fiber, and shape-memory alloys.

This company established the New Basic Materials Business Promotion Department and High-Tech Research Institute in May this year, and ventured into positive expansion of its sector of new basic materials.

Among new basic materials, this company has a reputation for those in the chemical sector. With the thought that the development of new basic materials by the company is also to be started from this sector, it inaugurated a New Business Planning Committee in April last year, and realized such undertakings as to absorb and merge with Kawasaki Chemical Co. Thus the company is achieving fairly good results.

Through the merger the company set up the "Chemical Research Center" in November last year, and this center started with a staff of about 70 members. It is carrying out its development by narrowing down the targets to the advanced fields including carbon fiber, fine chemicals, and C_1 chemistry.

Since about 10 years ago it has been conducting research on fine carbon with coal-tar, a secondary product arising when coke is manufactured, as a raw material. In the course of this research, it industrialized "KMFC," a raw material of isotropic carbon materials. Facilities with a monthly output of 5 tons are in operation at the Chiba Ironworks.

As it has a superior physical feature, such as showing isotropy after molding, it is enjoying rapidly increasing demand as a material for crucibles for the manufacture of semiconductors and for machine parts, as well as for electrodes for discharge processing. There are many inquiries from abroad, too, so the company will strengthen its facilities so as to have a monthly output of 30 tons, six times that at present, with the expectation that the new facilities will start operation this autumn.

Full-Fledged Development of Carbon Fiber

Concerning carbon fiber in the coal pitch group, the company has been carrying forward research and development jointly with Nitto Boseki Co., Ltd. In August, however, a pilot plant with an annual output of 12 tons will be completed in the Technology Research Institute (on the premises of the Chiba Ironworks), and it is expected to enter a full-scale development stage even as early as this year.

This coal-pitch long fiber has an advantage from the viewpoint of cost, too, as against the long fiber in the PAN (polyacrylonitrile) group, which constitutes the main stream. Therefore, one can expect it will enjoy a huge demand in the market several years hence.

In the field of iron powder, which has shown good results, the company has developed compressible atomized iron powder of high purity for OA machines, and it will be put on sale in the near future. In addition, its policy is to work for an expansion centered on new basic materials which other companies have not yet developed, giving priority to amorphous materials, fine ceramics, and composite materials.

The company itself undertakes new fields, especially at the stage of research on new basic materials, and at the same time conducts positive joint research with companies engaged in businesses of different kinds. Thus, its way of doing things is quite contrary to that of Nippon Steel Corp. which utilizes its subsidiaries.

Five years hence the company will exceed other similar companies in its transformation.

Mitsubishi Metal Corp.--The Processing Sector Is the Drawing Power for Profits

Mitsubishi Metal Corp.'s high earning capacity is acknowledged in non-ferrous metal business circles. The non-ferrous metal business circles have been obliged to conduct strict management due to market trends and the structure of the business circles. Recently, however, they are about to enter a new

development period with new basic materials, such as electronic materials, as a weapon. Among other companies, Mitsubishi Metal Corp. has gone ahead in effecting diversification by turning out processed products, and electronic materials which constitute the non-refining sector, and it is showing favorable business results.

The corporation's ordinary profit in the March term of 1985 amounted to Y9.741 billion, up 74 percent over the preceding term, breaking the prevous high record (Y9.510 billion in the March term of 1974) for the first time in 11 terms. This shows a clear difference from the profits of other companies in similar business, which still stop at 60 percent or so compared with the peaks in the past. The sales by this corporation amount to Y323 billion (67 percent of the total) in the refining sector consisting of gold, silver, copper, etc., Y103.8 billion (22 percent) in the processed products sector, Y43.2 billion (9 percent) in the sector of electronic materials and products, and Y11.1 billion in other sectors.

On the other hand, looking at the profit structure, 40 percent of profits are in the refining sector, 51 percent in the processed products sector, and 9 percent in the electronic materials and other sectors. In other words, processed products are drawing power for profits. The mainstay processed products include ultra-hard tools, powder metallurgical products, and diamond tools. Also, the main electronic materials are related to semiconductor materials, such as silicon wafers, lead frame materials, target materials, bonding wire, IC packages, and compound semiconductors. These items are produced from raw materials and supplied in an integrated operation.

Mitsubishi Metal Corp. is carrying out its "Second Star Program" aimed to achieve Y1 trillion in sales in the March term of 1993. This is designed to obtain, 8 years hence, a yearly turnover 2.1 times the sales in the March term of 1985, Y481.3 billion. The drawing power for this purpose consists of two sectors, processed products and electronic materials, and not the unstable sectors for the refining of gold, silver, copper, etc. The corporation is expecting an annual growth rate of 20 to 30 percent from the two sectors.

Placing Expectations on Electronic Materials

The corporation already carried out its "First Star Program" based on the March term of 1983. This was designed to achieve Y400 billion in sales and more than Y10 billion in ordinary profit in the March term of 1986, exceeding the Y343.9 billion in sales and Y5.3 billion in ordinary profit in the March term of 1983, and Y600 billion in sales and Y18 billion in ordinary profit in the March term of the final year 1988, and to carry out an annual dividend of Y5. However, the corporation decided to start the "Second Star Program" because it achieved Y481.3 billion in sales, Y9.7 billion in ordinary profit and paid a dividend of Y5 in the March term of 1985, as mentioned above.

The leading role for the "Second Star Program" is being played by processed products and electronic materials. Expectations are being placed on electronic materials in particular. As the mainstay of this sector consists

of materials related to semiconductors, its growth is blunted for the time being. But this is due to temporary adjustment. One can expect at least 20 to 30 percent growth from a medium- and long-range point of view. The corporation is therefore planning to invest as much as Y100 billion in this sector during the next 5 years. If electronic materials are added as a new leader to the processed products sector, which is the current pillar, this will be all that can be desired, and the medium-term plan also will be achieved fully.

Dowa Mining Co., Ltd.--Electronic Materials Sector Expanding Rapidly

This is the 101st year since this company purchased the government-operated Kosaka Mine in 1884 and entered the mining business. It has so far been engaged in the refining of non-ferrous metals. However, what this company aims at with the approach of the new century is to renew itself to become a manufacturer of high-tech materials.

The company has come up with this concept: "We will make our company grow into an enterprise wtih a yearly turnover of Y200 billion within 5 years. An increase in income, amounting to Y70 billion, will be achieved by the non-metal sector consisting of electronic materials, processed materials, engineering, etc., so that it will become equal to the non-ferrous metal-refining sector." This is aimed at changing the company's managerial make-up by shifting its profit structure from the market type to a stable type, and, moreover, to a high-rate growth type.

The key to success or failure in this undertaking is in the field of new electronic materials including compound semiconductors and magnetic materials, and in the field of new basic materials.

The company's tackling the field of electronic materials is by no means early in comparison with the four top-ranking companies in similar business. All the more because of this, it is taking a positive posture in waging offensives in the field of next-generation products, such as compound semiconductors and magnetic substances, and it is working for a rollback.

In August 1982 it set up the Semiconductor Materials Research Institute in its Akita Plant, and advanced into the compound semiconductor business. It succeeded in industrialization in less than 2 years after starting to foster single supplies. In March this year it strengthened its capability to produce gallium arsenide wafers which are expected to attain big growth as a material for high speed IC's, not to mention optically functional elements, to a monthly output of 15,000 wafers (in terms of 2 inches) at one shot, three times the preceding output. Also as to indium phosphorus, which is expected to be extensively used for laser diodes for optical communications and for field-effect transistors (FET) for satellite communications and microwave transmission, the company has established crystal-growing techniques and started sample shipments recently.

As it is conducting continuous-process production from the refining of ore, which is a raw material, to the manufacture of wafers, it has the forte of accumulated know-how which other manufacturers do not have.

Having Access to the Field of Magnetic Substances, Too

In the field of magnetic substances, on the other hand, full-scale production of metal powder for 8-mm VTR has begun at the Okayama Refinery. In September 1984 the company completed a mass-production plant with a monthly output of 15 tons and waited for the appearance of the 8-mm VTR. As Sony and others started selling VTR's of this type after the start of this year, and as tape manufacturers have also started to produce it, the company has started full-scale supply, and this is bringing profits.

Following the production of metal powder, the company is planning to commercialize, even this summer, barium ferrite for vertical magnetic recording, which is regarded as promising as a magnetic substance in the next generation.

With compound semiconductors and magnetic substances as two pillars, the company estimates the sales of electronic materials in this business year at Y5 billion, an increase of 67 percent.

Materials related to electronics are also beginning to appear steadily in the wake of compound semiconductors and magnetic substances. There is no end to the list of these materials, such as DK series of copper lead frame materials, fine ceramics, and shape-memory alloys.

The company is moving in the direction of development from general basic material to diversification and higher added values. It is certain that the company will tread the path of a high-tech enterprise for the next 100 years.

Mitsubishi Heavy Industries, Ltd.--Top-Ranking Defense-Related Enterprise

The amount of this company's contracts with the Defense Agency was Y235.9 billion (11 percent of the total sales) in 1984, the largest among the companies concerned. This has continued for 12 years, and it is more than twice the scale of Kawasaki Heavy Industries, Ltd., which ranks second.

The sales in the aeronautics, space, and tank sectors amounted to Y260.8 billion in 1984. Of this, about 80 percent is sales to the Defense Agency, including fighters and tanks. When space equipment including rockets and other items for the National Space Development Agency is included, this company's sales connected with the government budget account for more than 90 percent. The sales related to private demand, including civil aircraft, are less than 10 percent.

Among the main projects incorporated in the 1981 Medium-Term Operations Estimate (consolidation plan covering fiscal 1983-1987 period), procurement drives were pushed from fiscal 1985 for such weapons as "AH-1S" anti-tank

helicopters and "F-15" interceptor fighters worth about Y7 billion per plane (fuselage plus engines). The orders for "F-15" fighters are stable, with their number standing at 15 on the annual average, and they are beginning to make great contributions to this company and Ishikawajima-Harima Heavy Industries Co. (engines).

The aeronautics/space sector is a field of big expectations and it is expected to show rapid growth in the future. Even if the defense budget framework of less than 1 percent of the GNP (gross national product) were not achieved, the sales by this company, which has an overwhelming share in the defense equipment sector, can be expected to increase. If the 1 percent framework is achieved, the possibility of rapid growth in its business achievements is expected to become stronger than ever.

Even apart from defense-related business, the company has concluded a main contract for the design of experimental modules under the manned space station program of the United States. Thus it has obtained a foothold for its leap forward in the space sector, too. It plans to construct in Aichi Prefecture, in the autumn, a space equipment plant, the first of this kind in Japan, to manufacture rockets and manned space equipment.

Aeronautics/Space Sector Is Decisive Factor for Growth

The motor sector of this company, consisting of many kinds of turbines for power generation, boilers, etc., has been supporting its business achievements for the past 10 years. This is because its positive measures, including its starting of motor exports ahead of other companies in business circles, produced satisfactory results. Following its shift from shipbuilding to motors, its aeronautics/space business is thus about to reach a growth period as the third pillar. Whether or not it will continue to cut a conspicuous figure as a superior enterprise even in the 21st century depends upon growth of the third leading actor, that is, the aeronautics/space business.

It seeks to achieve sales accounting for more than 20 percent of the total 5 years hence, and to increase its profits markedly. It is extremely positive for the establishment of technology in particular. In the aeronautics/space sector, electronic control techniques are said to be a decisive factor for development. Therefore, Nagoya Aircraft Manufacturing established the Electronics Technology Department in 1982 and expanded to a staff of 300 members by April of this year.

Traditionally, electronic control techniques including services, have been left utterly in charge of the electric machinery manufacturers. Taking this opportunity, however, the company is beginning to create a structure based on two aspects, the establishment of its own technology and the strengthening of sales engineers.

Due to the complete change in its business situation, the company achieved a remarkable increase in profit in the preceding March term. It is expected to increase its profit to a great extent in this March term, too, because a

profit from the sale of Mitsubishi Motor Corp. stocks is to be added. Even from a medium-range point of view covering the next 5-year period, its prospects are bright due to expansion of its aeronautics/space sector. There will be many hurdles to leap to make it a "gold mine," but it is certain to grow into a third profit pillar.

Ishikawajima-Harima Heavy Industries Co., Ltd.--Advanced Sphere Expanding

The general heavy machinery manufacturers, who capitalize on their products of the "traditional heavy" type, are filled with enthusiasm about high-tech strategy. They are giving a greater impetus to the strengthening of their existing key fields on the one hand, while on the other they are making efforts for the development and introduction of technology in new advanced fields including electronics, new basic materials, and biotechnology.

This is because the high-tech revolution has expanded to such new spheres as space and oceanic development, and brought about the prospect that these manufacturers will become leading actors in the renovation of technology. This is also a challenge for enterprises of the traditional heavy type, which have reached the period of maturity, to develop continuously as industries supporting the economy of Japan in the future, too. Therefore, various companies are all the more serious.

This company is also tackling a wide range of themes from the judgment that, "It is necessary to combine the technology of the traditional heavy type and that of the light and soft type, and fulfill a leading role in building a more affluent society."

As to new materials, its targets include fine ceramics, composite materials, crystal-controlled alloys, super-fine particles, amorphous materials, and molten salt. It is hastening research on the use of fine ceramics for the blades of turbo-engines and for the vessels of gas turbines, and on the use of composite materials for gas turbine blades.

Concerning electronics, the company is directing its energies to research on optical technology, optical sensors, lasers, artificial intelligence, and high-energy beams. The application of lasers to chemical reactions is showing considerable progress, and it is likely that the company will soon reach the stage of putting it to practical use. Also, a facilities diagnostic system using artificial intelligence and an expert system collecting the knowledge of intellectual persons in various circles, are progressing steadily. In the field of biotechnology, it is carrying forward research on the testing of cultivation of giant kelp and on the techniques for the production of hydrogen by opto-synthetic micro-organisms.

In addition to these, the company has wide-ranging themes such as special bonding, powder molding techniques, surface treatment techniques, thin-film sensors, and techniques concerning ultra-high vacuum equipment. It intends to push forward these themes effectively, while drawing up long- and short-term plans.

Space and Aircraft Projects Entering a Leap-Forward Period

The space/aircraft sector is one of the company's important fields. It is trying to improve its technology by taking part in a project to develop new-type jet engines (V2500) and in planning for space rockets and manned space stations.

The sales in this sector in 1985 amounted to Y106 billion, exceeding Y100 billion. A breakdown by product shows that Y93 billion is for jet engines, Y8 billion for space equipment, and Y5 billion for gas turbines. The ratio of sales is still about 13 percent of the total, but it is likely to increase rapidly in and after 1986. This is because production of F-3 engines for new middle-class trainers and V-2500 engines under joint development by Japan, the United States, and European countries is on the right track.

This company is having an eye to "precision heavy industry" in which high technology is incorporated, as seen in such space and aeronautics industries. This company's sales at present are about Y800 billion, 75 percent of which is held by the mature field and 25 percent by the growth field. However, it intends to double its sales to Y1.5 trillion 10 years hence. It seeks a 50 percent sales in the growth field at that point in time.

Mitsui & Co., Ltd.--Communications Business Facing Big Reform

1985 is a year for a big reform in the telecommunications business, and it can take its position as an important year in the history of telecommunications, too. In other words, the Nippon Telegraph and Telephone Public Corp.'s transfer to private management (based on the Nippon Telegraph and Telephone Corp. Law) and the opening of telecommunications business to private enterprises (based on Telecommunications Enterprise Law) were carried out from April, and the telecommunications business has made a new start on the new principle of shifting from "monopoly" to "cooperative competition."

With the privatization of the Nippon Telegraph and Telephone Public Corp., NTT, the biggest private enterprise of this kind in Japan, has been inaugurated on the one hand, while the telecommunications business has been opened to the private sector on the other, and thus it has attained full-scale liberalization. Moreover, its scope is not so small in scale as can be expressed in terms of step-by-step liberalization with circuits used, as has been the case so far, but it ranges over telecommunications as a whole. For this reason, there are successive moves to advance into "Type 1 telecommunications business" (so-called second telegraph and telephone), for which enterprises themselves establish circuit facilities and furnish services. First, there appeared the following three companies constituting the so-called above ground group: "DAINIDENDEN Inc." (Kyocera group), "Nippoon Telecom Co., Ltd." (Japan National Railways), and "Teleway Japan Corp." (Construction Ministry and Japan Highway Public Corp.). They were followed by the various companies in the so-called satellite group. This group is also called the trading company group or the Japan-U.S. combination. It consists of Mitsui & Co., Ltd., C. Itoh & Co., Ltd., "Japan Communications Satellite" affiliated

with Hughes of the United States, Mitsubishi Corp., Mitsubishi Electric Corp., "Space Communications" affiliated with Ford of the United States, Marubeni Corp., Nissho Iwai Corp., Sony Corp., and "Satellite Japan" affiliated with RCA of the United States. The satellite group appeared later than the above ground group, but it is attracting attention by helping to avoid communications equipment friction between Japan and the United States.

Japan Communications Satellite Co. Taking the Lead

Japan Communications Satellite Co. came to the fore earlier than any other members of the group. Moreover, it is viewed as moving one step ahead of them in the development of communications business. This company has quadrupled its capital to Y1.6 billion. However, the rates of investments are not changed, 40 percent by C. Itoh & Co., and 30 percent each by Mitsui & Co. and Hughes Communications. The capital increase this time is designed to cope with the demand for funds arising from the company's starting to manufacture of satellites. It is planning to increase its capital regularly in the future, too. It is scheduled to increase the capital to Y28 billion, 17.5 times the present amount, when it launches satellite No 1 in late 1987. Japan Communication Satellite Co. already concluded a contract to purchase an "HS393-type" satellite (1.36 tons) manufactured by Hughes, and paid Y1.6 billion in design development expenses for TWTA (traveling wave tube amplifier) which constitutes the heart of the transponder, antennas, light-frame structures, etc. In addition, it paid Y5 billion out of its satellite-related investments amounting to Y75 billion.

Prospects for the telecommunications business are bright. According to the Telecommunications Consultative Council, the market scale of telecommunications business is expected to expand from Y5.5 trillion in 1980 to Y10.4 trillion in 1990 and to Y19.1 trillion in 2000, for such reasons as progress in the shift to advanced information and active markets due to competition.

Establishment of Japan Communications Satellite Co. by Mitsui & Co. and C. Itoh & Co. is really a project with an eye to the year 2000. There is a party for joint management and there may be restrictions on Mitsui & Co.'s independent activities. However, development of its new media business in the future is to be noted, partly because it is also showing positive results as an agent for Northern Telecom.

Mitsubishi Corp.--New Business Becoming Diverse

Mitsubishi Corp. carried out a wide-scale change of its articles of association for the first time since the "big merger" in 1954. The enterprises it has newly added through the latest change of the articles of association include the telecommunications business, the operation of medical facilities, and the finance business. The change is aimed at meeting such purposes as extensively developing the new media and new service fields, and at the same time making its finance-related business, which has so far been complementary to its main business, its regular business. An extensive addition of software business is also an important feature. This is due to the growing need to

acquire such intangible assets as industrial ownership, copyrights, know-how, and software, and of planning and sales.

Together with its advance into the telecommunications business and the finance business, its advance into medical business with the coming of the aging society is to be noted.

Recently it has received an order for the construction of a hospital together with Fudo Construction Co. This order came from Saudi Arabia under a package contract amounting to some Y16 billion, ranging from the construction of a general hospital which, if completed, will be the biggest in the Middle East, to the delivery of medical equipment. This is a big project with the construction period lasting until October 1988.

Not stopping at the construction of hospitals and delivery of medical equipment, the company is showing enthusiasm for new business, too. In other words, it started in June 1984 a "MIS (Medical Information Service) Research Society" and is groping for a medical business which suits Mitsubishi Corp. This is intended to make the most of the fact that it has been moving ahead of other companies in the import and sales of medical equipment, and is also advanced in research on hospital business (management of hospital chains) in Europe and America.

Medical Information Company Set Up by Groups

As part of this business, 11 companies including the Mitsubishi group at the center have established the "Advanced Medical Information Service" (AMS), a company to furnish medical information. AMS will make a full-scale start on medical information service covering those who are connected with medical treatment, such as medical doctors and pharmacists. For the time being it is conducting feasibility studies. As the first step it will install CAPTAIN system AMS monitor terminal units at medical institutions in Tokyo, Osaka, and Nagoya. Information to be furnished by AMS for immediate purposes will include general medical news, insurance news, news of overseas medical affairs, academic reports concerning new medicines and those for medical treatment and examination, and thesis reports. It is also planning to give medical data base services. Mitsubishi Corp. has agreed with the American Medical Association on sales in Japan of "AMAINET," the association's medical data base. "AMAINET" is a data base for clinical and pharmaceutical information about some 1,200 kinds of medicine, which are put on the market with more than 5,000 designations. It furnishes such information with an on-line system using the GTE telenet medical information network. The company has decided to carry out experimental services through the "AMAINET" and AMS networks.

Mitsubishi Corp. has made a good showing as to hardware for medical treatment, and it is steadily producing satisfactory results in the field of software, too. Therefore, it is expected to develop as a full-scale general medical business in the future.

Nippon Yusen K.K.--Supported by Monetary Assets and Real Estate

The depression in the marine transportation business is showing signs of extending over a long period of time, even without the failure of Sanko Steamship Co., Ltd. Even in the case of Nippon Yusen K.K., which holds the top-most position in marine transportation business circles, the situation of its shipping sector is as bad as those in other companies in the shipping business circles. In the March term of 1985, this company had ordinary profits amounting to Y15.2 billion, up 46 percent over the preceding term. However, the breakdown shows that the profit in the shipping sector was almost zero, and it is earning money by such means as management of its monetary assets and income from real estate. Ordinary profits come from fields not connected with its main business, including Y10 billion through employment of its monetary assets, Y2 billion from its unloading facilities for container ships, and about Y1.5 billion in income from rental buildings. Although the shipping sector is depressed, it is not that there are no surplus sectors, such as ships for automobiles. There are LNG (liquefied natural gas) ships, too, which are expected to be used in the future. However, it seems impossible to place big expectations in the future on the mainstay regular liners, general non-regular liners, and tankers. So long as the worldwide shipping surplus remains unsolved, management of monetary assets and income from real estate will become increasingly important. Above all, big expectations will be placed on an increase in income from real estate.

"Easing of restrictions" on the marine transportation business is being realized. In concrete terms, 1) one has only to make an ex post facto report to the Transportation Ministry on an investment of less than Y1 billion; and 2) it has become possible to pay a 10 percent dividend, a condition for a capital increase through issue of stock at the market price, due to the review of the interest subsidy system.

Such "easing of restrictions" will help in further enhancing the dominant position of this company, which has strong overall power including its investment surplus power, and it will likely give impetus to the diversification of its business. Of course, the company has so far been pushing diversification in a positive way, including international intermodal transportation and real estate business.

Its development toward the real estate business has become active especially of late. It is carrying forward effective use of land for company housing, etc., in cooperation with Mori Building Corp., a major developer, while endeavoring to absorb management know how for the real estate rental business. It intends to tackle positively the city redevelopment plan, too, from a medium-range standpoint.

Plan To Participate in City Redevelopment

Even in the national capital region and the Hanshin area alone, the company has 14 places (320 houses) for company housing for employees' families, with a total site area of 29,000 square meters, and seven dormitories for unmarried

persons and seamen with a total site area of 14,000 square meters. There are many cases where most of these facilities are not in effective use. Therefore, it plans to consolidate the company houses and dormitories and build on remaining land ferroconcrete apartment houses of a better class, office buildings, etc., thereby earning rental income.

The income from real estate location in the March term of 1985 was Y3.4 billion, and about Y1.5 billion on an ordinary-profit basis. Construction of office buildings, etc., is showing an active development, and it may be fully possible for the company to obtain Y5 billion in income and Y2 billion in ordinary profit 3 years hence, and Y7 billion in income and Y3 billion in ordinary profit 5 years hence.

From a medium-term point of view, the company's participation in city redevelopment projects is to be noted. There are such projects centered on international cities including Yokohama and Kobe, such as "Yokohama's Minato Mirai 21," in which leading business organizations participated. For the project "Yokohama's Minato Mirai 21," the company possesses 2,700 square meters of land in groups in the Takashima District, and it is planning to construct buildings for rent. The book value of the land is low, and the amount of the land potential is very large, so the medium- and long-term development of the company's real estate business can be expected.

20,151/9599
CSO: 4306/3560

NEW MATERIALS

SUBSTRATE MATERIAL-PURPOSE THIN FILM DIAMOND DISCUSSED

Tokyo ELECTRONIC PACKAGING TECHNOLOGY in Japanese Sep 85 pp 17-21

[Interview with Dr Nobuo Setaka, chief researcher of the Science and Technology Agency's National Institute for Research in Inorganic Materials; interviewer, date, and place not specified]

[Text] Introduction

The electron CVD technique developed by an Aoyama Gakuin University Research Group is a technique of synthesizing a high quality thin film of diamond in a short period of time. This is a recently publicized method using diamond as a new material for substrates. The National Institute for Research in Inorganic Materials [NIRIM] of the Science and Technology Agency [STA] is the first Japanese group to research this field in depth. NIRIM has achieved many excellent results so far by a system of limiting the research period to 5 years, a method not yet adopted by other institutes.

[Question] When did you begin research on diamonds?

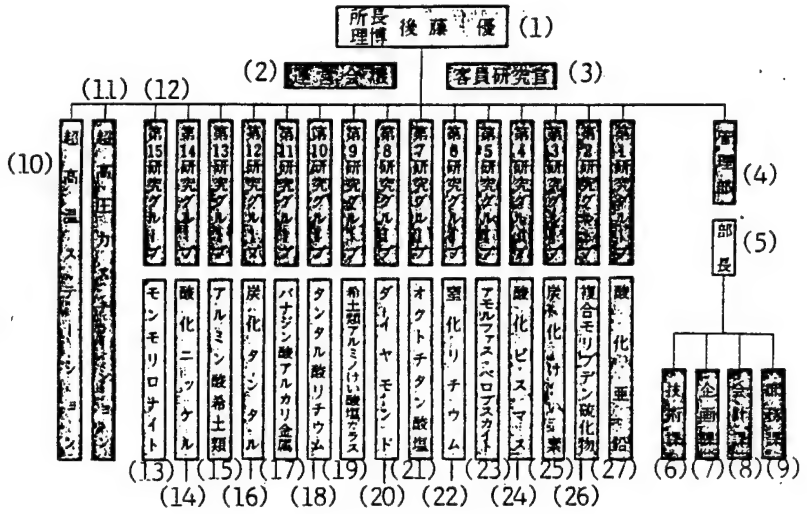
[Answer] It was about 10 years ago. Our first diamond group used a catalyst to synthesize a single crystal diamond under static high pressure. We are working on a system of limiting the research period to 5 years, which is one of the features of our research institute. Once a research objective has been accomplished by a group, the group is disbanded and another new research group is reorganized under a new subject. Among research groups, ours can be said to be peculiar. Our group has just entered the third stage of research.

[Question] What were the goals and objectives at each stage of your research?

[Answer] The first stage of our research was centered on formation of a single crystal.

[Question] Is that what we call artificial diamond?

[Answer] That is right.



Key:

1. Director Masaru Goto
2. Operational council
3. Guest researchers
4. Administration department
5. Department head
6. Technical section
7. Planning section
8. Accounting section
9. General affairs section
10. Ultra-high-temperature station
11. Ultra-high-pressure station
12. Research groups 1-15
13. Montmorillonite
14. Nickel oxide
15. Rare earth aluminate
16. Tantalum carbide
17. Metal of alkali vanadate
18. Tantalum-acid lithium
19. Rare earth amino silicate glass
20. Diamond
21. Ocototitanate
22. Lithium nitride
23. Amorphous
24. Bismuth oxide
25. Carbonized silicon
26. Compound molybdic sulfides
27. Zinc oxide

[Question] It is produced at high pressure and high temperature, right?

[Answer] The pressure is between 45,000 and 50,000 bar and the temperature is between 1,450 and 1,500 degrees centigrade. The second stage of our research was centered on the multicrystal diamond.

[Question] What exactly is this like?

[Answer] Normally, diamond is a single crystal. The fine powdered diamond is baked into a solid by a DC servo motor under high pressure and at high temperature to produce a so-called sinter. As the second stage of our research approaches its end, a thin film gradually came into being. The gas phase synthesis of diamond was the main theme for the third stage of our research.

Excellent Characteristics

[Question] For what purposes are single and multicrystal diamonds used, respectively?

[Answer] Diamond has many excellent characteristics, such as hardness, excellence of heat conductivity and sound-wave propagation velocity, and the capacity to become semiconductorized with doping of impurities, etc. All these characteristics permit use of the diamond as an industrial material. The single-crystal diamond is used for research and as material for cutting tools or being used as heat radiation panels for semiconducting elements. On the other hand, the multicrystal diamond is used in tools for cutting light alloys or for dies.

[Question] Alumina AL_2O_3 is mainly used at present for heatsink. Is diamond used to a considerable extent?

[Answer] Yes, it is. It is used to a great extent.

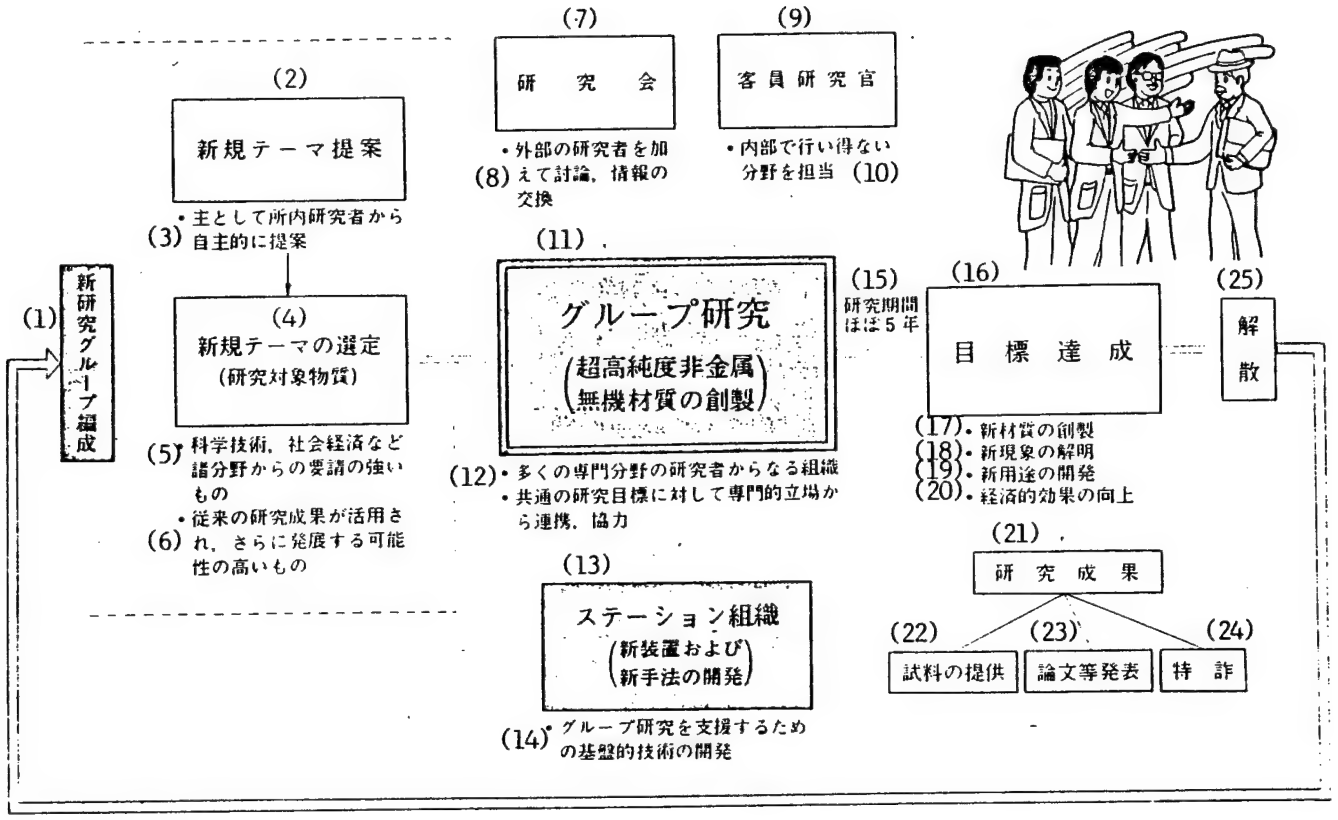
Four Kinds of Diamond

[Question] Basically, how many kinds of diamond are there?

[Answer] There are two types, type I and type II, and each has a and b. Thus, there are four kinds: Ia, Ib, IIa, and IIb [diamond].

[Question] How are they classified?

[Answer] It depends on the density of nitrogen. Type I is relatively high and type II is low in nitrogen content. The degree of this nitrogen content produces changes in the rate of heat conductivity. The lower the nitrogen content, the better the heat conductivity rate. Of the four kinds, type IIa is used for heat radiation panels, but this type IIa is very low in output despite its increasing demand.



Research System and Research Work Flow Chart

[Key on following page]

[Key for flow chart]

Key:

1. New research group formation
2. Suggestion of new themes
3. Theme suggested mainly by researchers in the institute
4. Selection of a new theme (materials centering on a research)
5. Strong demand arising from various fields of scientific technology, social economy, etc.
6. Research results achieved in the past fully utilized with high possibility of further development
7. Research meeting
8. Discussion with researchers from outside and exchanges of information
9. Guest researchers
10. In charge of fields where it cannot be handled internally
11. Group research (creation of ultra-high purity non-metallic inorganic materials)
12. Organization consisting of researchers in many specialized fields; tie-up and cooperation in common research objectives from specialized viewpoints
13. Station organization (development of basic technology to support group research)
14. Development of basic technology to support group research
15. About 5-year research period
16. Objective achievement
17. Creation of new materials
18. Clarification of new phenomena
19. Development of new applications
20. Improvement of economic effects
21. Research results
22. Test data supply
23. Release of dissertations, etc.
24. Patent application
25. Disbandment

[Question] What is type IIa used for?

[Answer] It is used for heat radiation panels for semiconductor lasers, Gunn diodes, etc.

[Question] The fact that demand continues to increase despite the small output is the reason why they are made artificially, isn't it?

[Answer] That is so. However, we are not continuing research with this as the main purpose. Unlike the case with manufacturers, ours are limited strictly to basic research. Type IIb is diamond displaying characteristics of a semiconductor with boron content and which, furthermore, is called "white blue" and is valued as a jewel.

[Question] Meanwhile, when was the thin film diamond announced?

[Answer] The fall of 1981--so actually 1982.

[Question] What was the method you used at that time?

[Answer] By means of heat filament CVD, which can be said to be an improved CVD technique.

[Question] Various methods are currently being used. Could you give us a brief account of them?

[Answer] One method is pyrolysis of a formed radical of low molecular-weight hydrocarbon on the surface of a superheated substrate, and the other is to induce diamond by means of making either a formed low molecular-weight hydrocarbon ion or a carbon ion collide with the surface of a substrate after being accelerated in an electric field.

[Question] In this case, does the ion collide with the substrate at a relatively high speed?

[Answer] No. It collides at low speed somewhere between 40 and 900 electron volts. At a speed of more than 1 K electron volts, it spatters. Therefore, it is necessary to make the ion collide with the substrate at a speed less than 1 K electron volts.

[Question] The image of man-made diamond is that of being produced in a high-temperature, high-pressure environment. That image should be changed, shouldn't it?

[Answer] That is right. Metallic solvent synthesis in a high-temperature, high-pressure environment satisfies requirements, but is not an absolute prerequisite. Even by this method of synthesizing, black lead is sometimes produced instead of diamond.

[Question] Where is the research going on at present?

[Answer] At universities, private enterprises, etc. The success in diamond synthesis achieved by the Soviet inorganic material institutes has revealed that diamond can be synthesized at atmospheric pressure and with a simple device, thereby permitting any one to make diamond, if so inclined.

[Question] What conceivable uses are there for diamond in view of the fact that the research is underway at that many places?

[Answer] I do not know much about that, but as there are many possibilities, it is yet to be known. The targets have already been set. Because of diamond's excellent characteristics, however, the processes up to that are yet uncertain. Because of the diversified possibilities, our efforts are for the research. However, it is believed that this leads to immediate industrialization.

Heading Toward Industrialization

[Question] When do you think actual industrialization will be?

[Answer] I cannot forecast when it will be.

[Question] The issue of heat conductivity deserves special attention, doesn't it?

[Answer] Yes, it does. After all, a technique has already been set up to increase the degree of accumulation as seen in the super LSI, and if the problem of heat radiation is solved, further progress will continue. The heat conductivity rate of gallium arsenide is inferior; it is about one-fifth that of diamond.

[Question] Besides that, what about electrical resistance?

[Answer] Diamond is also relatively high in electrical resistance, having good insulation quality. All this indicates that diamond has additional characteristic elements besides semiconducting which is the greatest attraction.

[Question] Then, for the moment are all of you looking at diamond usage in substrate-related items and in super LSI in terms of actually putting diamond to use?

[Answer] Yes, definitely. However, the semiconductor itself has problems. For example, p-type exists, but n-type is not yet in existence. Therefore, n-type must first be produced. In addition, it is necessary to produce semiconductors with the least defects possible. Thus, an extension of the existing synthesizing method may not work well. Therefore, we must develop synthesizing techniques for the future. In the present situation, it has become generally accepted since the diamond can be synthesized at a pressure lower than atmospheric pressure. That is why everybody began research, but at

this stage, it poses problems in industrializing it now. Techniques relating to semiconductors or thin films are progressing to a certain degree. Therefore, synthesizing equipment is being developed on the basis of such techniques. There are many synthesizing methods--to name a few, the ion vaporization method, microwave plasma CVD method, ion beam vaporization method, with respective variations for each method. Which is superior to the other industrially is a problem for the future. Each has advantages and disadvantages. Different synthesizing methods will be developed according to uses. There is the problem of mass production together with the problem of quality. They are said to be problems for the future.

Diamond is Eternal

[Question] Are you thinking about the fourth term of research?

[Answer] Our diamond group only, having special characteristics is now in the third term of research. Following operational policy of the institute, we do not know about the future. However, if a new theme is proposed and adopted, a new group may be organized. Our research entered the third term last year and it is still in progress now.

[Question] At the present how many people are there in your group?

[Answer] There are five at present.

[Question] What are they related to respectively?

[Answer] They are in such related areas as high pressure, single crystal, baking; atmospheric pressure, etc. No one can say anything about what our research will be in 3 years. Private research may be ahead of ours, and then research seems to have started even in the United States.

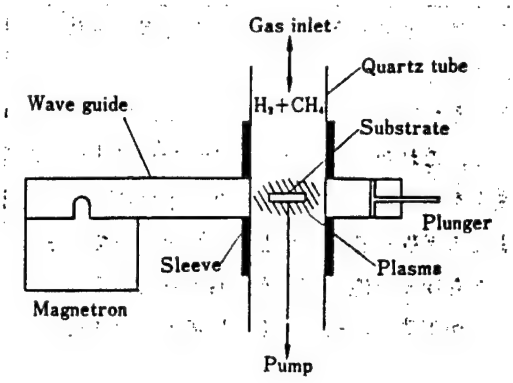
[Question] What are the positions of Japan and the United States in this research?

[Answer] The United States has done hardly any research up to now, but I believe there will be relative progress in the future, including increases in the number of researchers and research expenses.

[Question] Then, does this mean Japan is at the top level?

[Answer] No, the Soviet Union has been continuing research ever since the mid-1960's success in the synthesis of diamond under low pressure by (Daliyargin) of the physical and chemical research institute in Moscow. Not much is known about their internal affairs, but it is presumed they are first.

[Question] What do you think will happen to thin films of diamond as material for substrates in the future?



Microwave Plasma CVD Device

[Answer] The same substance in different forms brings about various new uses. From this viewpoint, the gas phase synthesis of diamond under low pressure can be said to be very attractive. However, actually there are many problems for us--problems of nucleation speed, adhesion of diamond to substrates, enlarging equipment capacity, synthesis of n-type semiconductors, etc. Unless each problem is solved one by one, diamond will not be developed as industrial material. We wish to go ahead with our research in anticipation of unknown possibilities. Our research will correspond literally to the words "diamond is eternal."

20130/9599
CSO: 4306/3571

ROBOTICS

STATUS OF HAZARDOUS ENVIRONMENT ROBOT DEVELOPMENT EXAMINED

Tokyo TOSHI KEIZAI in Japanese Feb 86 pp 14-15

[Article: "Challenge to Human Mechanism--Industrial Robot Market 10 Years Hence Likely To Be Y1.4 Trillion; Large Project of Undersea Oil Developing Robot"]

[Text] Positive Development in Japan, the United States, and Europe

With 1980's "First Year of Robot Diffusion" as momentum, robot applications starting with simple operations such as handling and reloading have expanded and diffused rapidly to higher levels along with the improvement of their functions, thus allowing Japan to be a big robot country with about 60 percent of the world's industrial robots. By OEM [Orignial Equipment Manufacturer] supply and technical tie-up, Japanese makers have boldly advanced into overseas markets in Europe, the United States, Southeast Asia, and Australia.

Robots currently find applications overwhelmingly in manufacturing industries such as automobiles, electric appliances, synthetic resin processing, metallic goods, and metallurgical machines, but demand in the future is expected to expand to nonmanufacturing industry areas such as the nuclear industry and ocean development. Incidentally, a long-term forecast of demand announced the other day by estimates of the Japan Industrial Robot Manufacturers Association, provided demand goes along the maximum curve, production in 1990 is expected to be Y690 billion and in 1995 Y1.39 trillion. Since production for 1985 can be estimated at Y340 billion, it is to expand slightly over four times by 1995.

Under such circumstances, the Agency of Industrial Science and Technology, MITI, has advanced a large project of "Research and Development of Ultimate Work Robots" on a 5-year plan since fiscal 1983. The project, aimed at developing robots for operations related to atomic energy, for support of undersea oil development and for responding to disasters, is being watched in anticipation of expanding demand in nonmanufacturing industry areas, as well as largely improving the technical level of robots.

An "ultimate work robot" is one which does work in place of humans under extreme conditions for them such as in a vacuum or under very high hydraulic

pressure, and its development is referred to as truly an "engineering challenge to the working mechanism of an organ."

A number of factors required of this robot include the ability to operate remotely eliminating the need for human intervention in the worksite and high mobility plus operability by autonomous control, versatility and extendability permitted by the use of tools and machine tools and adaptability to a complex environment. They largely exceed the area of technology of robots for factory automation (FA) which are being introduced these days into industry. It is, so to speak, future technology and will need much time before practical use. While its positive development is underway in Japan, the United States and Europe, the advent of a high performance robot is expected in the 1990's.

To put such a pioneering robot into practical use, it is indispensable to realize a locomotive mechanism. The developmental target is focused on this point, and the development is being pursued of a mechanism which permits a robot to climb up and down stairs, avoid or travel over obstacles and further travel at a high speed on a wall or ceiling. On the other hand, elemental technologies, besides the locomotive mechanism, of the pioneering robot include the visual system, induction method and control system, research into which is also being actively pursued. Let us take a look at an undersea oil development support robot and a nuclear robot of the ultimate work projects by the Production Engineering Agency.

High-Performance Robot Under Development

Oil extraction is shifting from land to shallow sea areas and further to the deep sea. Platforms for oil extraction need periodic inspection because of sea shells attaching to them or corrosion. However, work under the sea is hard and, at considerable depths it is beyond human capacity.

There are only three undersea oil extraction bases around Japan, while the level of manufacturing technology is high resulting in a number of orders for platforms being accepted. There are currently slightly under 4,000 platforms in the world which will be operational for 10-20 years until the oil is exhausted at each of them, thus resulting in a great demand for inspection work.

The undersea oil development support robot is being developed by MITI as a large project. The approximately 3.2-m-long, 2.7-m-wide, 2.7-m-high robot is disc shaped and reportedly capable of submerging 50 to 200 meters in the sea.

The Oki Electric Industry Co. is in charge of supersonic image and communication devices corresponding to a robot eye, and with regard to its drive elements, Kawasaki Heavy Industries Co. and Komatsu Ltd. have charge of a variable vector propeller plus working legs and actuators (drive part) for leg joints, respectively. The robot can be controlled by optical fibers from on board a ship at sea. Sumitomo Electric Industries, Ltd. is responsible for the development of optical fibers and a gyro for the sense of direction for the robot, and Mitsui Shipbuilding & Engineering Co. is responsible for its

Top 30 Companies' Ranking in 1984 Robot Sales

(unit: millions of yen;
figures in parentheses are for previous time)

Ranking	Company Name	1984	(1983)
1(1)	Matsushita Electric Industrial Co., Ltd.	32,000	23,000
2(2)	Fanuc, Ltd.	13,369	10,006
3(3)	Yaskawa Electric Manufacturing Co., Ltd.	10,000	7,000
4(6)	Dainichi Kiko Co., Ltd.	9,022	6,400
5(3)	Kawasaki Heavy Industries, Ltd.	8,000	7,000
5(3)	Hitachi, Ltd.	8,000	7,000
7(7)	Fuji Machine Manufacturing Co., Ltd.	6,500	5,200
8(8)	NACHI-Fujikoshi Corp.	6,000	5,000
8(42)	Toshiba Corp.	6,000	400
10(9)	Mitsubishi Electric Corp.	5,500	4,500
11(10)	Toshiba Machine Co., Ltd.	5,000	4,000
12(13)	Kobe Steel, Ltd.	4,300	2,800
13(17)	Osaka Transformer Co., Ltd.	4,229	2,300
14(11)	Star Seiki Co., Ltd.	4,200	3,800
15(15)	Sankyo Seiki Manufacturing Co., Ltd.	4,000	2,550
16(12)	Fuji Electric Co., Ltd.	3,300	2,900
17(14)	(Harmo) Co., Ltd.	3,100	2,780
18(21)	Nippon Electric Co., Ltd.	3,000	2,000
19(32)	Seiko Electronic Industry Co., Ltd.	2,680	700
20(20)	Orii Co., Ltd.	2,622	2,083
21(23)	Citizen Watch Co., Ltd.	2,580	1,780
22(19)	Taiyo Steel Co., Ltd.	2,500	2,200
22(17)	Kondo Seisakusho Co., Ltd.	2,500	2,300
24(16)	The Sailor Pen Co., Ltd.	2,200	2,400
25(28)	Kaijo Electric Co., Ltd.	2,150	1,215
26(24)	Toshiba Seiki Co., Ltd.	2,003	1,730
27(39)	Gaderius Co., Ltd.	2,000	500
27(21)	Mitsubishi Heavy Industries Co., Ltd.	2,000	2,000
29(25)	Motoda Electronic Industry Co., Ltd.	1,850	1,500
30(27)	Tokiko, Ltd.	1,600	1,300

Source: Surveyed by NIHON KEIZAI SHIMBUN.

body and stationary legs. The Agency of Industrial Science and Technology aims at completing it in 5 years. Thus we are nearing an age when divers' operations can be done by a robot with three eyes and many legs.

Ultimate Work Robots in the Timetable

Two types of robots are considered for nuclear energy: One is a high-function general purpose robot capable of traveling with its four legs on the floor overhauling and checking valves and pumps, and the other is a wall surface traveling robot for inspection and decontamination of waste liquid tanks within buildings for waste disposal.

In the case of a floor walking four-leg robot, for example, its eye, capable of stereoscopic vision, is being taken charge of by Fujitsu, Ltd., a visual information processing mechanism by Toshiba Corp., a hand manipulating machine tool for humans by Mitsubishi Heavy Industries, Ltd., legs incorporating an actuator by Hitachi, Ltd., and photo space transmission by Mitsubishi Electric Corp.

A four-leg walking robot for atomic-energy-related operations is currently in the stage of conceptual design and has yet to be trial-manufactured, while high technologies are to be applied to it so that the birth of technologies is likely which can be widely applied to industrial robots when the robot is completed in 5 years.

As has been stated, Japanese industrial robots are advancing toward being increasingly intelligent, as well as having high speeds and high-precision motion by the introduction of innovative technologies such as autonomous control, remote on-site control, and intellectual remote control. With an ultimate work robot so far regarded as future technology in the timetable, the demand for industrial robots in Japan in the future is likely to expand in an accelerated manner from the manufacturing industry, the conventional mainstay, to nonmanufacturing industry areas such as atomic energy, ocean, disaster prevention, and construction.

20,117/9599
CSO: 4306/543

SCIENCE AND TECHNOLOGY POLICY

FUTURE DIRECTION, POLICY FOR BASIC INDUSTRIES DISCUSSED

Tokyo JIHYO in Japanese Apr 86 pp 68-71

[Speech by Kazuo Iwasaki, director general of MITI's Basic Industries Bureau at the 23d meeting of the Tora Research Policy Study Group on 20 Feb 86]

> [Text] After hanging in the air for 15 years, the sense of crisis concerning the future of basic industries is now at last trying to emerge from its long tunnel. A "New Basic Materials Research Society" was initiated and a new light has been shone on basic industries. That is a "revival of the chemical industry." If such is the case, then what direction will basic industries probably aim for in order to meet the new era of internationalization?

Chemical Industry Revival

At present, I am proposing a revision for the operation of the law Concerning the Examination of Chemical Substances and Regulation of Manufacture, etc., (chemical investigation law). This law was created through the opportunity provided by the PCB incident of 1973, however, I would like to express my thoughts as to why it should hereafter be revised.

Eight years ago, when I was director of steel operations, there was an assembly of the Federation of Economic Organizations [Keidanren] called the "Consultation On the Problem of Basic Industries." Representatives from every industry gathered with the object of considering what the long-term nature of basic industries ought to be. As might be expected, there was a strong sense of crisis within the assembly as to whether or not basic industries would be developed in Japan.

This assembly is now being reorganized into the, "New Basic Materials Research Society." This can be thought of as one symbolic change. In other words, basic industries, which have been inside of a tunnel for 15 years, are gradually beginning to see the light, and this is probably a sign that a bright light is shining on the road ahead. It can now be called a "revival of the chemical industry."

Now, the first main factor leading to this "restoration" was the conquest of pollution. If you think about it, 15 years ago the Japanese islands were in

the middle of a pollution shock, and the image of basic industries as ecological polluters had spread. Even among economic associations, the opinion that it would be good to transfer polluting industries to developing countries appeared. Talk was also heard that the number of students in university chemical engineering programs had declined.

Afterwards, as the result of efforts to prevent pollution, which was like a blood stain on firms, the former image was wiped away, and recently the number of students majoring in chemistry has increased. In this regard it is important that pollution, such as water pollution and PCB Pollution, not again become a problem. Not giving rise to pollution is an essential condition for the future development of basic industries. The revision of the chemical investigation law is based on this premise.

The second main factor of the "revival" was that the opportunity was taken to develop new basic materials and biotechnology.

These two main factors gave a sense of direction to basic industries.

Building a "Room" For Research Development

However, it is not a situation without problems. For example, there is a need for large amounts of capital and for many area specialists in order to develop new basic materials and biotechnology research.

I believe that one condition for the development of industry in Japan up to the present was that the efficient utilization of manufacturing technology was planned for with expert knowledge, apart from individual companies. As a result, Japan can boast of first class manufacturing technology in any industry.

However, in creating new technology in the future, such a planning principle may not be adequate. Designated research development funds are becoming smaller, and in terms of diversification, personnel may also prove to be a limit. It is said that the new technology of the future will be the synthesis of vast technologies, and large amounts of research funds and long-term future investments are necessary. Accordingly, MITI has exerted efforts over the past 2 to 3 years into building a "room" for this type of new technological development, and now the question is what will flourish in the "room."

One such "room" is the financing of basic technology research centers that are composed of research groups from more than two companies. Company mergers are unrealistic, but the thinking is that at least the systemization of the research must be advanced.

It may seem like an irrational argument, but for example, those in the chemical industry may think that biotechnology is restricted to their particular field, but the path to biotechnology is not limited to chemistry. Biotechnology can also be approached through electronics, and, contrary to expectations, electronics may even be the shortest route. There will probably also be a situation where basic materials manufacturers may not know how to take

advantage of technological developments. In any case, there is no guarantee that 15 years from now the chemical industry will be the one succeeding in biotechnology.

The greater portion of new basic materials are used as substitute materials, and that portion used to exploit new needs is still small. Even if it were different, I do not hold the expectation that trying to exploit new needs would be immensely profitable. However, effort must be put into this area in order for companies to survive, and so it is done. It is not because heaven is already here.

Since it involves research in this area, I would like the research to be systematized while the nation supports it.

All the same, I would like a systematic plan, necessary for research development, that encompasses all technology. I would like a systematic plan that resolves problems in advancing research, such as determining the direction in which the research should advance.

Reversing Management's Posture

Something that has been felt strongly of late is that the markets of Japan are not "sacred grounds."

Based on the idea that production capabilities are more than adequate, Japan's pattern up to now has been to say let's regulate production, let's create cartels for slumps, or let's pass industrial structure laws and manage facilities. However, I have doubts as to whether or not facility management will improve the industrial structure as expected.

It is true, for example, that if you cut production facilities in half, supply and demand might be able to be regulated, but actually that's not enough. You may think that you balanced the supply and demand of the Japanese market, but it's only superficial.

This is the actual situation. In corporate management, and in production policies it must be underwtood that the domestic market is not isolated. The difficulty lies in this area. Just as government administration and corporate management have progressed until now riding piggy-back on the isolated nature of the domestic market, so now the recognition that it is not "sacred ground" is very important.

In looking at the export percentages over the past 25 years in Japan's steel industry, it can be seen that they have fluctuated somewhere between 25 and 35 percent. Because facilities investments were based on an estimation of maximum demand, there was temporarily a large uptrend in supply, and for that time the export percentage was high. The export percentage swelled from 25 to 35 percent.

Not only steel, but similarly, Japan's other major industries and companies developed their strategies based on an awareness of overseas markets. The current situation is one where we are making a living on a broad overseas market.

Here's what the EC (European Community) members are saying lately. Why are the Japanese manufacturers expanding their facilities so much? Isn't it because they have planned on dominating world markets from the beginning? In other words, it is a strategy of trying to blot-out our existence. In reference to these competitors, we have the right to use every means to assure our existence. An EC representative is saying that trade friction will not be resolved until Japan corrects its administrative posture, or stance.

The United States is the opposite of Japan. U.S. companies have had a "heavenly market" within the country and have had no need to look overseas. For example, the U.S. communications equipment market is four times the size of Japan's. It is not necessary for U.S. manufacturers to look at the Japanese market, which is only one-fourth the size of their domestic market, as vital.

This difference in management posture is at the root of the problem. Japanese companies are being pressed to reconsider their posture, regardless of right or wrong.

Nationality of Capital

Moving production bases overseas and investing overseas have been mentioned as plans to resolve trade friction. Another method that is also mentioned is to accept orders for overseas projects in cooperation with a U.S. or European firm, rather than independently.

Any of these plans may be good, however, one must also be careful in this area. Over presence is a metter that requires care. It is unacceptable to look at overseas investment as a cure-all.

In 1967, at which time I was the heavy industries commissioner, I sensed a problem after visiting Australia, and joined an investigative team in order to promote the liberalization of capital. Even now I remember the statement that, "there are no national boundaries for capital, but there are nationalities," which was written in the report at that time. Even now, my thoughts on this have not changed.

Within the steel industry there is no world enterprise. Even in its prime, U.S. Steel did not venture overseas. Steel is the base of a national economy, and countries that are aiming to become advanced countries, such as India, Egypt, Brazil, Korea, and others, first have a steel corporation that is based on domestic capital. It is something that holds a different sentiment than washing machines.

It is not limited to steel, and advanced countries also have the desire to possess advanced technology industries. It is being said that the EC will welcome investments in advanced technology industries from Japan, but, nevertheless, France and other countries probably wish that they had these industries themselves. An over presence in overseas investment also invites resistance. It will not be the deciding factor in resolving trade and economic friction. Therefore, what should be done? There is no such thing as a solution through a single plan. I believe that the only way is to combine and synthesize counter plans from various angles.

Yen Appreciation And Basic Industries

Finally, I will try to touch upon some off-the-cuff thoughts concerning the relationship between a high yen and basic industries.

First, the problem of cost for electrical power.

For any industrial area that you may pick, Japan has struggled and become a world leader in that area. However, there is one weak sector. That is the energy industry. Because of the high yen, an impact is being felt, profits are shakey, and the industry is being forced into decline. However, the tragedy is probably limited to the companies in this industry.

Even in that sense, the basic obligation of electrical power companies, and the policy stance that should be adopted, is a rate reduction only for those users that have lower electrical power costs because of the high yen.

To say what should be done specifically would require ample technological discussion, but I think that a method should be advanced along these lines.

One more point related to the yen's appreciation is that an industry's rivals come from other industries within the country.

Under the fixed exchange rate, competitors were overseas companies from within the same industry. However, with floating exchange rates, even though each firm cuts annual costs by 3 percent through economizing and reduction efforts, other industries' costs are cut temporarily by 15 percent, and, in the aggregate, exchange rates decline by 15 percent. The 3 percent cost reduction becomes completely wasted. In other words, the activities of other industries produce this effect.

It has become a very difficult time for the management of each company to develop strategies.

However, I definitely do not think that the so-called "small and light" will replace the "big and heavy."

Because the steel industry supplied deep drawn steel plates, Japan's auto exports increased. Moreover, these products can be purchased from any manufacturer without fear because the product quality is uniform between companies, and having a system where the demand for the steel plates can be supplied at any time became a precondition for the development of other industries.

No one can deny these facts.

13253/12859
CSO: 4306/3061 END